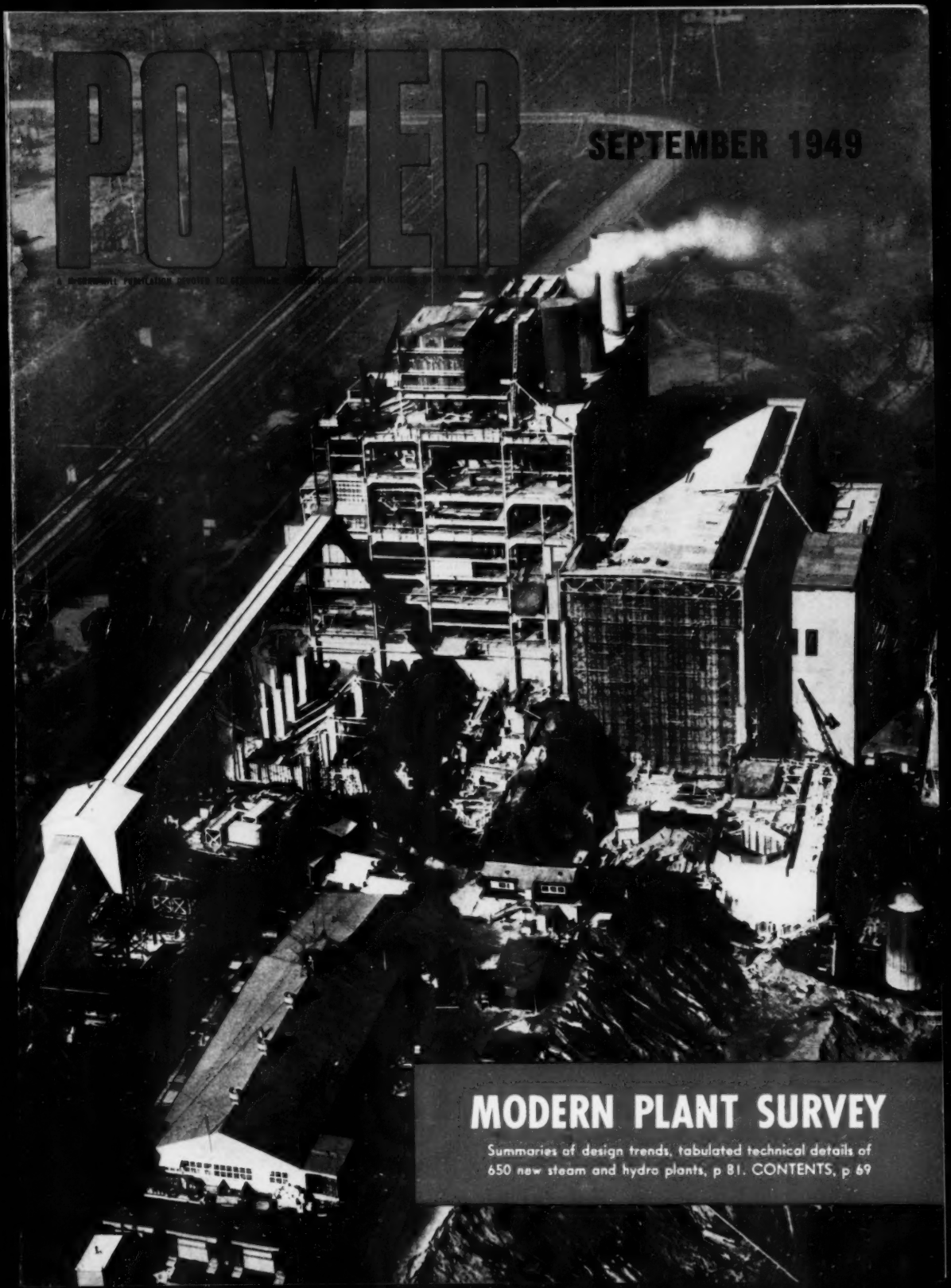
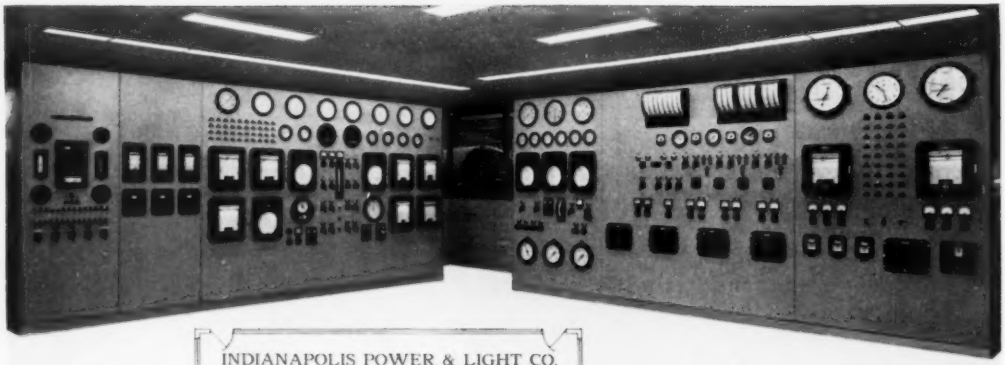
POWER

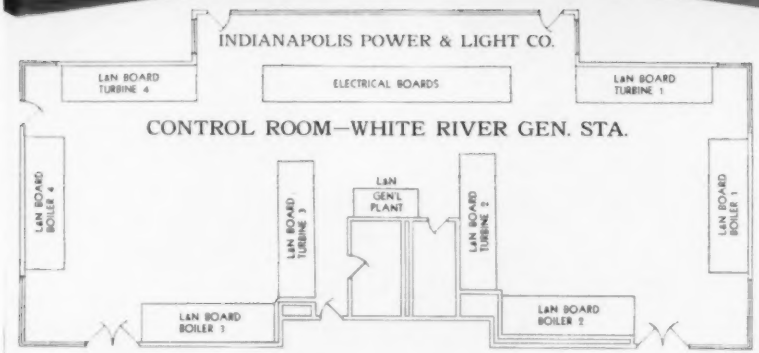
SEPTEMBER 1949



MODERN PLANT SURVEY

Summaries of design trends, tabulated technical details of 650 new steam and hydro plants, p 81. CONTENTS, p 69





L&N-designed and built Boards for Turbine 1 and Boiler 1

"PACKAGED" CUBICLES BY L&N SIMPLIFY CENTRAL CONTROL PROBLEMS

Indianapolis Power & Light Company is one of the public utilities which believes firmly in centralizing the control of boiler, turbine and generator at one spot in the plant.

In referring to the new White River station, for example, the Company says:* "The most unusual feature is the centrally-located Control Room which will eventually contain panels, instruments and controls for completely operating four units. Panels are arranged to give each operator a clear view of his boiler or turbine . . . remote indication of all operating flows, pressures, temperatures and liquid levels (are provided) . . . with suitable alarms."

"Panels supplied by Leeds & Northrup Co., contain controls for one boiler with convenient grouping . . . turbine controls on their own panels. An L&N general plant panel provides for air compressors, well-water and ash-sluicing pumps, water softener and station barometer plus alarms for necessary items. The control room is ventilated by a forced-air system. . . ."

* *"New 160,000-Kw White River Generating Station of Indianapolis Power & Light Co." by A. A. Benson;* Combustion, *May 1949.*

The engineering service rendered to I.P.&L. and to Gibbs & Hill, design and construction supervisors on the whole Station, extended far beyond the supplying of L&N instruments and controllers. After the owner and consultants had okayed our general suggestions, we completely engineered and built the boards. The assembled and tested equipment reached White River ready for connections to boiler, turbine and generator auxiliaries. The user saved much engineering and installation time, with associated reduction in overall cost, and has, in effect, a huge "instrument" for specific needs, to provide efficient operation with maximum ease and reliability.

Seventh Project in 17 Years

Six other applications of L&N equipment have been made for I.P.&L.; the first, involving both Combustion Control and Instruments, went into service in 1932, and White River is the Company's fourth station to use our products and services.

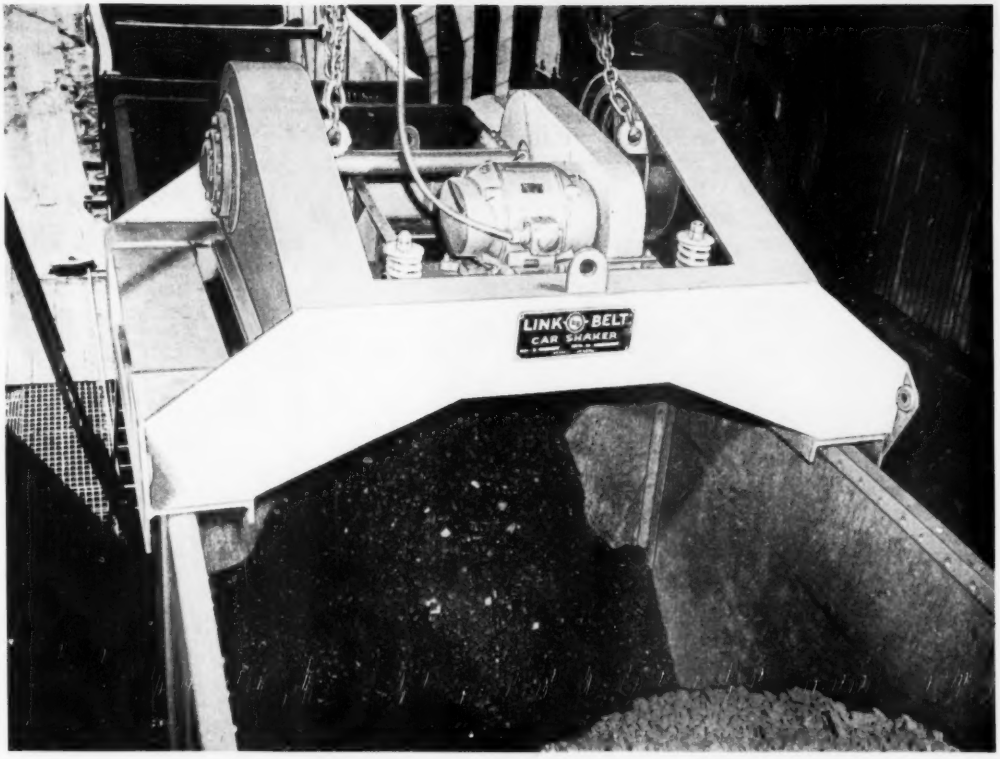
L&N control-engineering service is available for any control-panel problem, whether it involves an entire station or just one instrument. Address Leeds & Northrup Company, 4910 Stenton Ave., Philadelphia 44, Pa.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl Ad N-460(3)

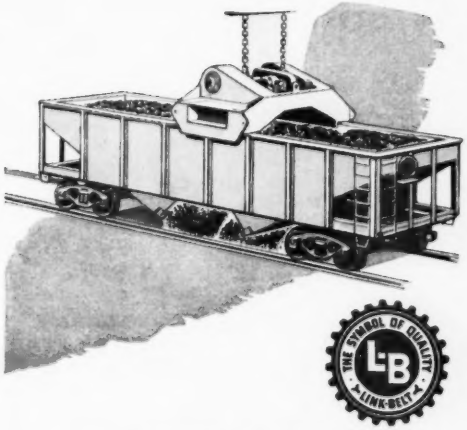
POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer" and "The Stationary Engineer"), September, 1949, Vol. 93, No. 9. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter January 26, 1949, at the post office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. Subscription rates—U. S. and U. S. Possessions $5 for one year, $7 for two years, 50c per copy. Canada $6 for one year, $9 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.



Now, you can unload bulk materials from hopper-bottom cars--
"broom-clean" and fast with

LINK-BELT CAR SHAKER

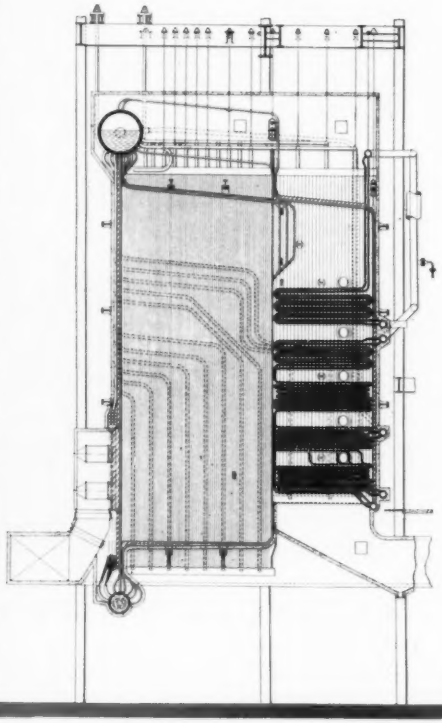
Lower the Link-Belt Car Shaker to the top of the car walls. Start the motor which delivers vibrations to the car sides and sloping hopper bottoms, loosening the material for easy "broom-clean" unloading in minutes. Reduce unloading costs and injury hazards and eliminate demurrage charges with this efficient unit. It is especially valuable for unloading damp or frozen materials. May we send you full information? Send for Book No. 2345.



LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.
Offices in Principal Cities. 11,599

A Million

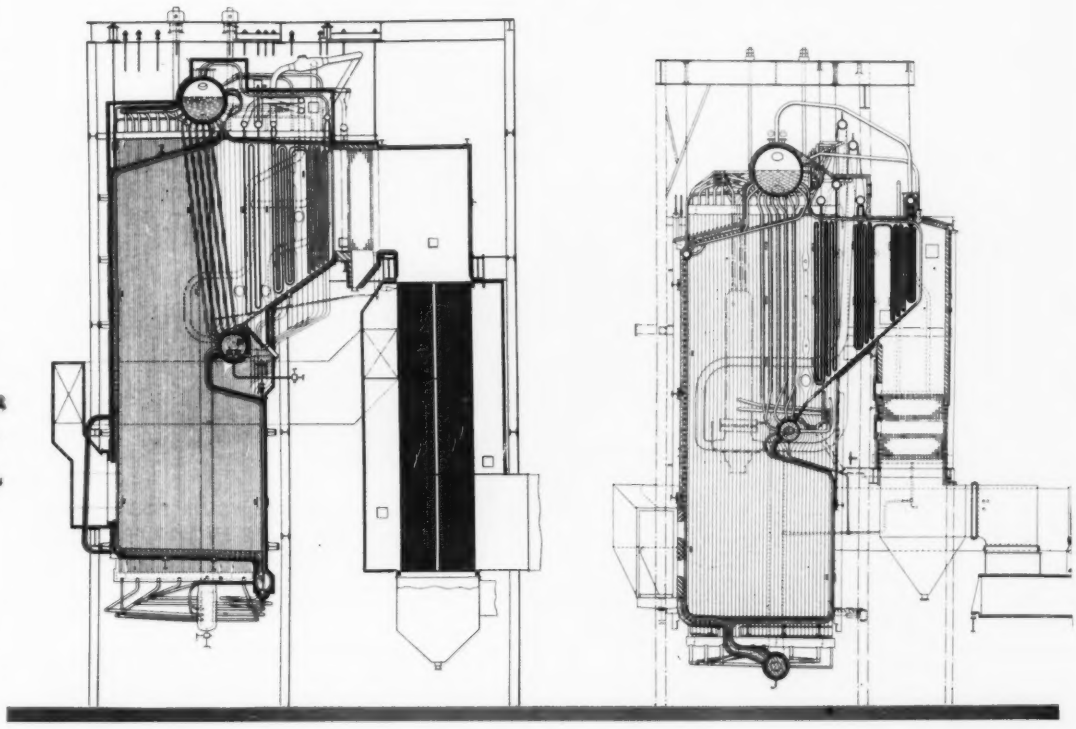


San Diego Gas & Electric Co.

One B&W Radiant Boiler of this design —575,000 lb. per hr. at 1475 psi, 950F —is on order for Silver Gate Station. Four other B&W boilers are now in service at this station

...with B&W Steam

NEW Kilowatts for California



Pacific Gas & Electric Co.

Fourteen new B&W Radiant Boilers, eight of this design and six of a modified design have recently been installed or ordered for service at three stations: *Kern*—four 450,000 lb. per hr. units. (2 for 1500 psi at 935F, and 2 for 1550 psi at 935F): *Station P*—four 475,000 lb. per hr. units, 1550 psi at 960F; *Moss Landing*—six 475,000 lb. per hr. units of the modified design, 1550 psi, 950F. All units are installed outdoors and fired by oil and natural gas.

Southern California Edison Co.

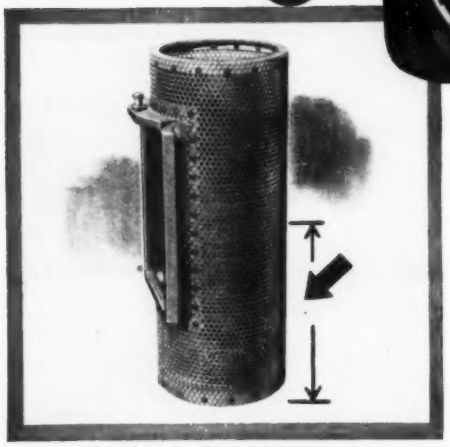
Seven B&W Radiant Boilers of this design—400,000 lb. per hr. at 1000 psi, 900F—have recently gone into service at the new Redondo Beach Station. All units are installed outdoors and fired by oil and natural gas.

BABCOCK & WILCOX

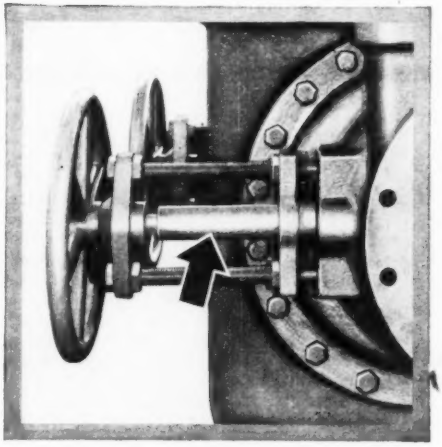
G-431

THE NEW Elliott

QUICK-VISIBLE VALVE POSITION INDICATOR — You can tell at a glance which basket is working by the position of the valve shaft. A nameplate located on the strainer body between the hand wheels, gives positive instructions.



LARGER BASKET CAPACITY— The ratio of basket area to inlet area is approximately 5 to 1 with standard mesh. Naturally, less frequent cleaning is required and the pressure drop is reduced.



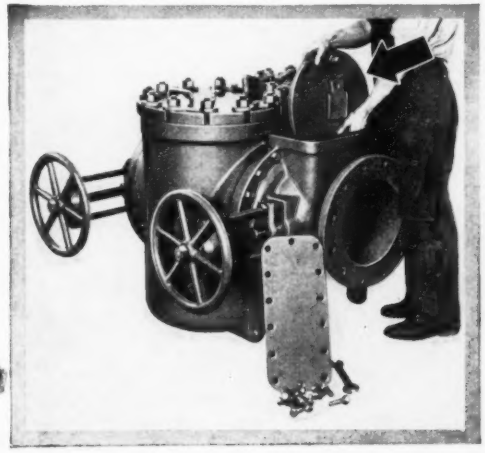
ELLIOTT COMPANY

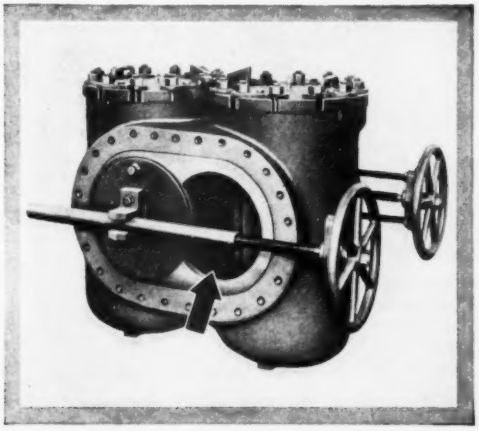
TWIN STRAINERS
lead the field in *many new features*

CHECK over the advantages in this new Elliott Type A Twin Strainer—designed to minimize pressure drop . . . to make cleaning easier, quicker, and less often . . . to simplify mechanical maintenance . . . and to add years of service life.

Elliott Twin Strainers are built in a complete line of sizes 1″ to 24″, for 125 lb. pressure and 1″ to 12″ for 250 lb. pressure. Many new developments besides those shown here, are described in the bulletin, sent at your request. Mail the coupon.

EASILY REMOVABLE VALVE DISC enabling replacing of valve disc ring without dismantling valve. Twin Strainers have gate valves, which brush off their valve seats before sealing.





NO LIQUID TOUCHES VALVE SCREW THREADS because the valve shaft, and not the valve screw, is in contact with the liquid.

A-298P

ELLIOTT COMPANY
Accessories Dept. — Jeannette, Pa.

Please send me Twin Strainer Bulletin A-13.

Name .....

Company .....

Address ..... *City* ..... *State* .....

Accessories Department
JEANNETTE, PA.
Plants in: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

Television in Industry
... the DIAMOND "UTILISCOPE"

Checking Boiler Pilot Burner Flame Conditions with the DIAMOND "UTILISCOPE."

At Tidd Station of the Ohio Power Company, another highly successful use of the Diamond "Utiliscope" has been developed by engineers of the American Gas and Electric Service Corporation. As shown by adjacent photographs it is used to enable the control room operator to see for himself whether the burner pilots in a boiler furnace are on or off. This is what the Ohio Power Company says in an article appearing in its employee paper: "Previously, the control room operator worked in conjunction with another auxiliary operator located at the boiler furnace burner area, both communicating over a public address system. This occasionally led to confusion, delay and hazardous practices during the critical period of lighting off burners to bring the boiler into service."

There are innumerable other uses for the "Utiliscope" because with it you can see where you can't look.

"Utiliscope" monitor or receiver is incorporated in control room panel where six glowing discs indicate that all pilot burners are lighted and that main burners can be turned on with safety.

"Utiliscope"—Registered U.S. Patent Office

"Utiliscope" camera is focused upon master mirror which receives reflections of six catseyes from smaller individual mirrors. In this way, flame conditions at six different ports in the furnace are watched by one camera.

DIAMOND POWER SPECIALTY CORP.

DETROIT 31, MICHIGAN

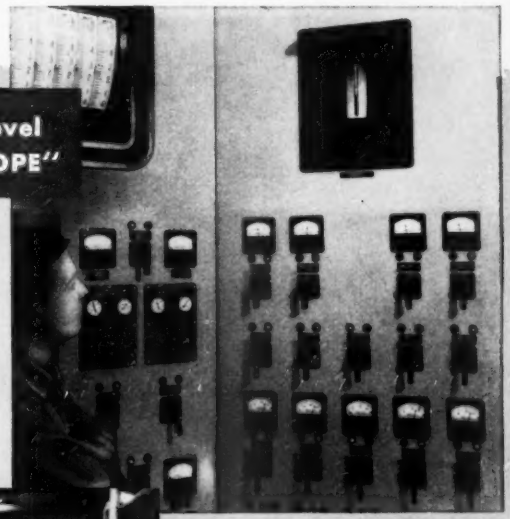
Diamond Specialty Limited — Windsor, Ontario

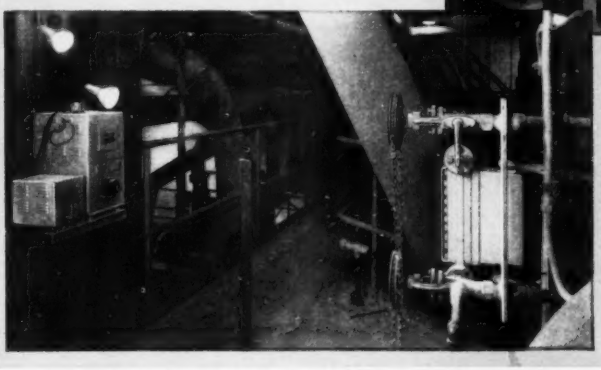
"Increased efficiency and safety in operation of boiler units has been the result."

(STATEMENT IN EMPLOYEE PUBLICATION OF OHIO POWER CO.)

Reading Boiler Drum Water Level with the DIAMOND "UTILISCOPE"

Tidd Station also uses a "Utiliscope" to bring the image of the boiler water gauge to the control room. With 60 individual images per second (sound motion pictures have only 48 per second), any change is instantly registered on the viewing screen . . . there is no measurable time lag. Distance, intervening walls, obstructions of any kind cause no difficulty. The "Utiliscope" has exceptional stability and reliability; it has fewer tubes than a good radio set and is built for continuous operation at temperatures up to 150° F. Installation requires no special skill and only a screw driver is needed for adjustment of focus, brilliance and contrast to suit individual preference.





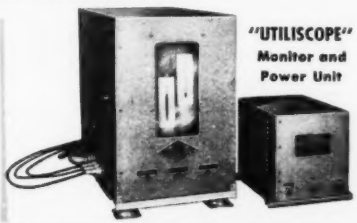
Exact image of boiler water level gauge is always before control operator on the "Utiliscope" screen. There can be no mistake . . . the correct water level is shown or there is no image.

The attention of the "Utiliscope" camera never wanders; it is permanently focused on boiler water gauge and continuously sees and shows every minute variation in water level.

Write for Bulletin No. 1013 which illustrates the "Utiliscope," describes its operation and suggests various applications that promote safety and economy.

For exactly, simultaneously and continuously picturing at a remote point . . . an object, operation or condition

"UTILISCOPE" Camera and Power Unit



"UTILISCOPE" Monitor and Power Unit

The "Utiliscope" is a product of the Capehart-Farnswörth Corporation and the Diamond Power Specialty Corp.

OTHER USES

- To observe coal feed to pulverizers or stokers.
- Destructive testing without endangering the operator.
- To observe secondary combustion, slag flow, etc.
- To check stacks for smoke.
- To reproduce readings of electric meters, liquid level or temperature gauges, etc., located at remote or inaccessible places.
- To observe radioactive materials behind barriers.

3955

2,800,000 Lb Per Hr of Controlled Superheated Steam

Produced in One Station by Foster Wheeler Twin Furnace Steam Generators

Slag-free Operation

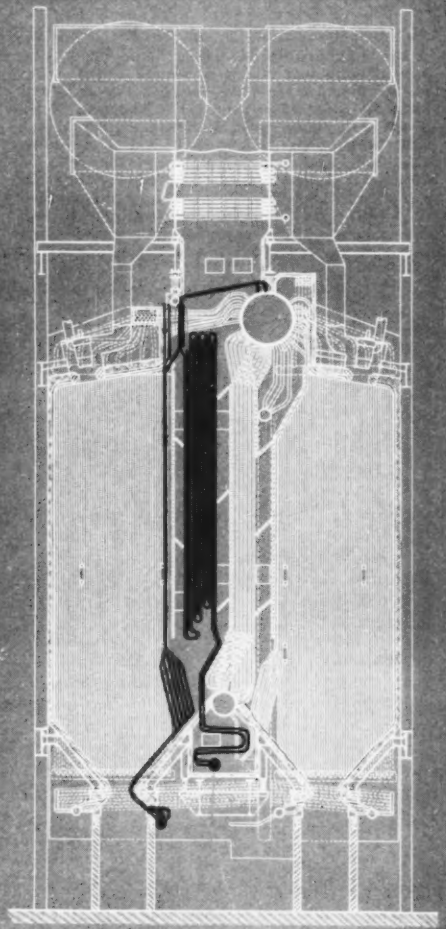
Furnace exit gas temperatures of high capacity, high pressure, high steam temperature units are established by the slagging characteristics of the fuel fired. The Twin Furnace design provides approximately 30% more cooling surface than a single furnace unit having similar furnace proportions.

Controlled Final Steam Temperature

By judicious proportioning of the surface of the radiant superheater located in one furnace and the convection superheater, a desirable flat characteristic steam temperature curve may be attained. Further control is obtainable by differentially firing the two furnaces thus stabilizing steam conditions for optimum turbine efficiency over the widest possible operating range.

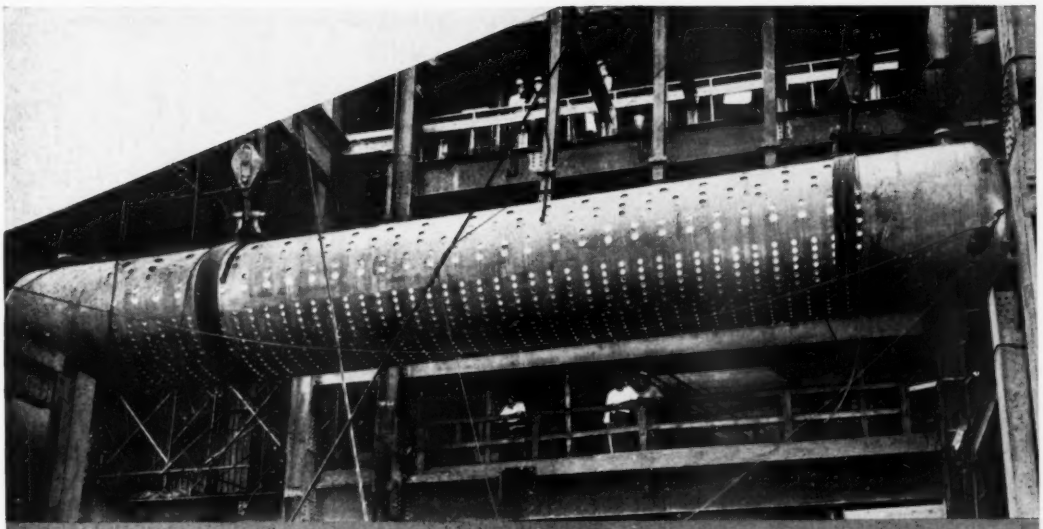
Compact Design

Substantial saving in building space is achieved through the use of smaller permissible furnace volumes with increased cooled wall area distributed in two furnaces and by compact arrangement of all component parts of the unit.

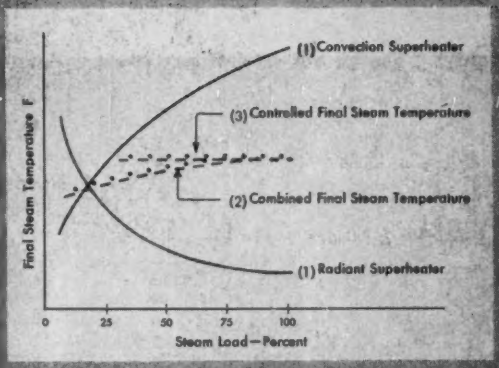


Duquesne Light Company
Phillips Power Station
Pittsburgh, Pennsylvania

Steam capacity	600,000 lb per hr
Superheat control range	270,000 to 600,000 lb per hr
Pressure superheater outlet	900 psi
Final steam temperature	900 F
Bituminous Coal Pulverized in FW Ball Mills	



An upper steam drum being placed in position at Unit No. 2 of the Phillips Power Station of the Duquesne Light Company.



Curves showing final steam temperature

(1) Convection and radiant superheaters operating independently

(2) Twin Furnace combination radiant and convection superheater

(3) Controlled differential firing at lower partial loads, minimizing the need for special temperature control equipment.

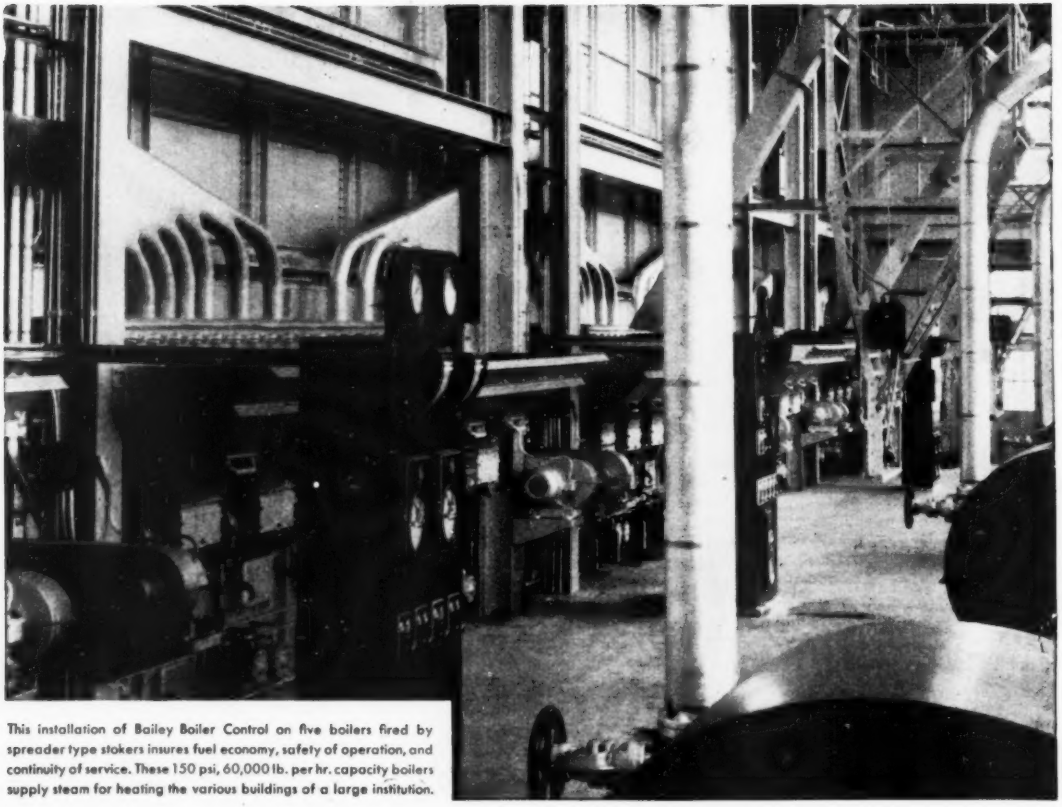
A total of 5 Twin Furnace steam generators—designed, engineered, and constructed by Foster Wheeler—will be installed at the Phillips Power Station of the Duquesne Light Company which serves a large area in and around Pittsburgh, Pa. Two are already in service and three are on the way. This station, which will generate 237,000 kilowatts when completed, is part of a system covering a territory populated by some 1,500,000 persons.

Growing preference for this ideally balanced design is evidenced by the fact that other large utilities are now using Foster Wheeler Twin Furnace steam generators. The Twin Furnace arrangement with combination radiant and convection superheater permits constant final steam temperature through exceptionally wide load ranges.

FOSTER WHEELER CORPORATION 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

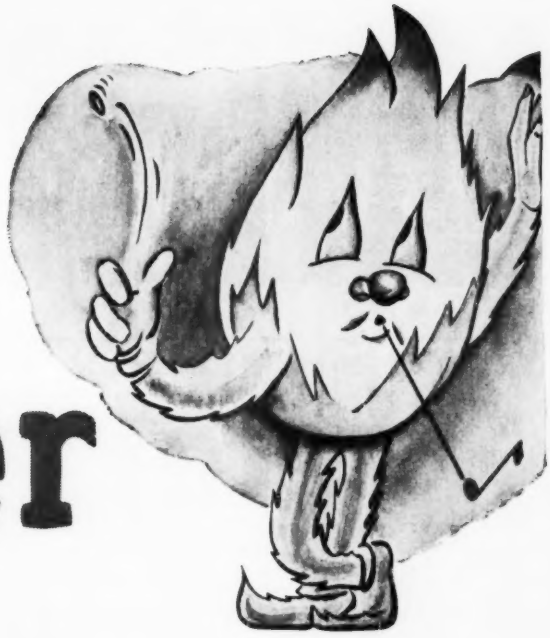
Loafing Btu's produce no



This installation of Bailey Boiler Control on five boilers fired by spreader type stokers insures fuel economy, safety of operation, and continuity of service. These 150 psi, 60,000 lb. per hr. capacity boilers supply steam for heating the various buildings of a large institution.

Branches *in*: Boston, New York, Schenectady, Philadelphia, Buffalo, Pittsburgh, Cleveland, Detroit, Cincinnati, Atlanta, Chicago, Milwaukee, St. Louis,

power



You find loafers everywhere. Even in a collection of Btu's. You have to *make* them work if you expect to get low cost power. And that is exactly what the Bailey co-ordinated boiler control system is designed to do.

It reduces fuel consumption per pound of steam generated. Combustion, feed water, steam temperature, heater levels, pump speeds and other factors are co-ordinated. Safety of operation is increased — continuity of service is improved. You convert the maximum number of Btu's into power and get all the efficiency your boiler was designed to deliver.

One thing to remember, however, is the fact that this Bailey system is not delivered in a standard package. Each one is designed and engineered to the specific job on which it is to be used. That's *why* it functions so efficiently.

If you are looking for low cost power, it will pay you to call our nearest office.

BAILEY METER COMPANY
1036 IVANHOE ROAD · CLEVELAND 10, OHIO
BAILEY METER COMPANY LIMITED, MONTREAL, CANADA

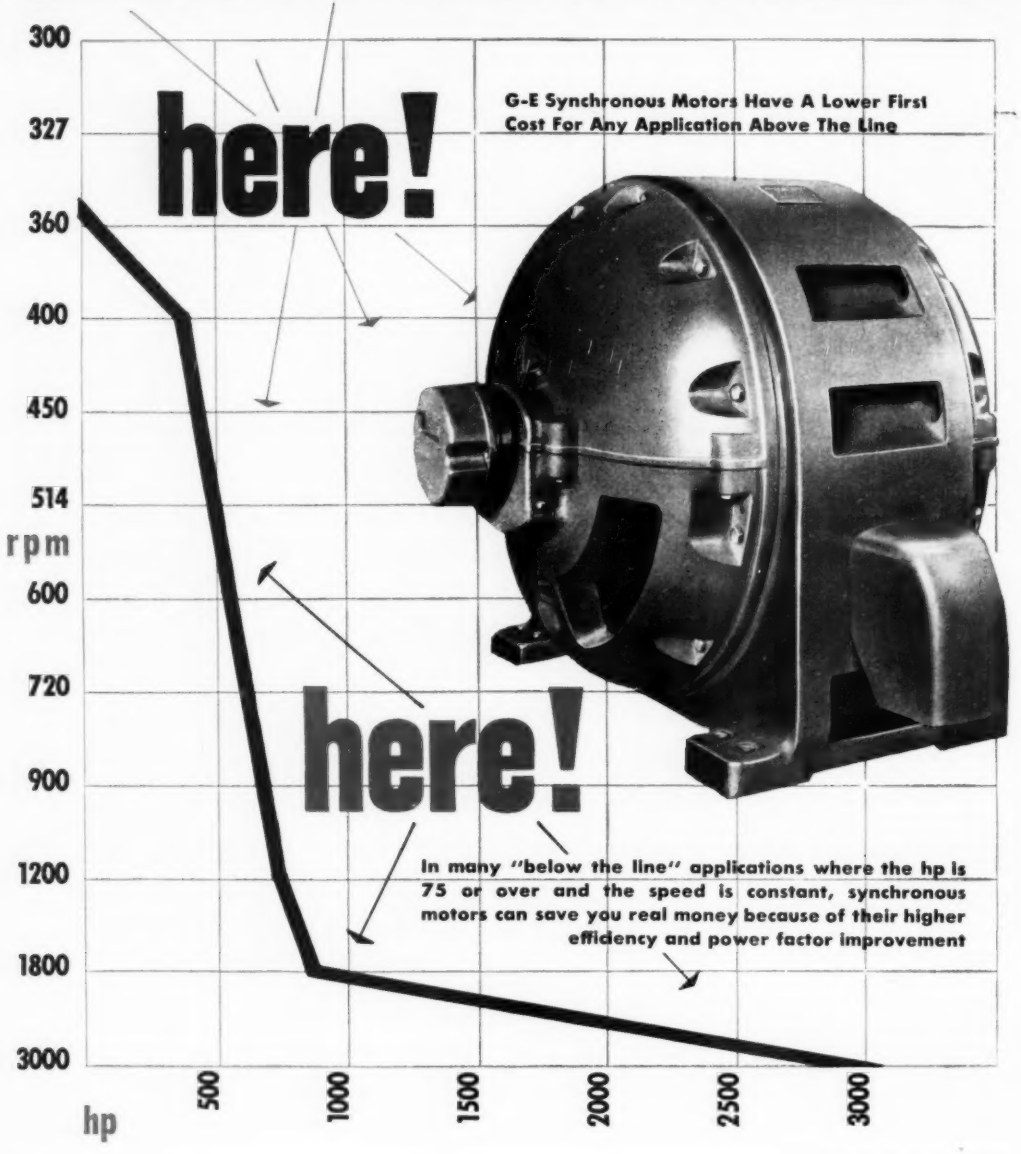
BAILEY METERS

Controls for Steam Plants
COMBUSTION · FEED WATER · TEMPERATURE
PRESSURE · LIQUID LEVEL · FEED PUMPS

A-104-2

New Orleans, St. Paul, Kansas City, Houston, Denver, Los Angeles, Seattle, San Francisco • Halifax, Montreal, Toronto, Winnepeg, Vancouver

SAVE MONEY!


300
327
360
400
450
514
rpm
600
720
900
1200
1800
3000
500
1000
1500
2000
2500
3000
hp
here!
here!
G-E Synchronous Motors Have A Lower First Cost For Any Application Above The Line
In many "below the line" applications where the hp is 75 or over and the speed is constant, synchronous motors can save you real money because of their higher efficiency and power factor improvement

USE GENERAL ELECTRIC SYNCHRONOUS MOTORS

In their natural fields of application, synchronous motors have a *lower first cost* than any other kind of motor!

When you specify General Electric synchronous motors, you get unequalled application engineering by experts in the electrical problems of your industry. They make sure you get the right motor—the motor that will give you the greatest return on your investment.

For your next large, constant speed motor, ask your General Electric sales representative for the full story, and how you can take full advantage of the money saving features of G-E synchronous motors.

GET THE MOST FROM YOUR MOTOR WITH G-E CONTROL

New rotor field circuit prolongs life of your motor and equipment. Offers: precise synchronization (within half a cycle); constant protection without "babying" the motor; automatic and instant field removal at slip cycle.

This factory assembled and tested unit is your assurance of accurate motor performance regardless of type of G-E synchronous motor control you require—full-voltage magnetic, reduced-voltage magnetic, or reduced-voltage semi-magnetic. Standard, heavy duty components are panel mounted, enclosed in a compact, steel cabinet. Short-circuit protection with air-circuit breakers or high-voltage fuses is available. All parts easily accessible, little maintenance required, adjustments easy.

This is the quality control your synchronous motor needs for really efficient operation. It is specially engineered and built for years of service for your application. Write for the bulletin in the coupon.

Apparatus Dept., Sec. H 770-4, General Electric Company
1 River Road, Schenectady 5, N. Y.

Gentlemen:
I would like more information on the advantages of synchronous motors. Please send me the indicated descriptive literature.

☐ GEA-529D ☐ GEA-5113 ☐ GEC-505

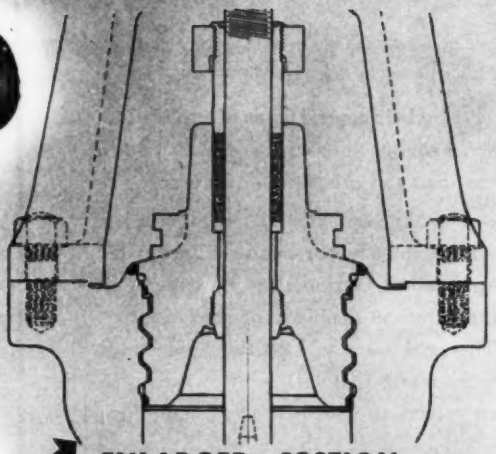
Name ..... Company .....

Street ..... City .....

State .....

GENERAL ELECTRIC

Breech Lock



ENLARGED SECTION BREECH LOCK JOINT

Breech Lock design also available in globe, angle, check and non-return valve patterns.

POSITIVE INSURANCE AGAINST BODY-BONNET JOINT LEAKAGE. NO MAINTENANCE REQUIRED.

Here's Why...

The Breech Lock design has no sealing surfaces to become damaged by corrosion, oxidation, or in disassembly, which might prevent reassembly of a tight body-bonnet joint.

Has no flanges, gasket, or bolting materials which demand periodic attention.

Joint tightness unaffected by sudden quenches, temperature variations, and creep.

Seal Weld leakproofs joint.

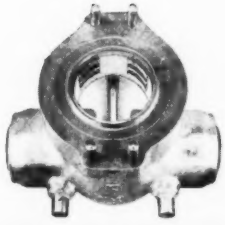
SEAL WELDED BONNET CAST STEEL VALVES . . .

Exclusively and Distinctively LUNKENHEIMER!

THE Breech Lock Valve is a patented design developed by Lunkenheimer to eliminate body-bonnet joint leakage on high pressure-high temperature service. In numerous installations in leading power plants the Breech Lock design has measured up to highest expectations, and definitely proved that it will not leak under the most severe operating conditions. Maintenance expense has been eliminated. A recent installation of these valves is in a central power station operating at pressures and temperatures up to 2100 psi at 1050° F.

The Breech Lock design is ideally suited for boiler feed and main steam line operation. All parts that tend to cause joint leakage because of their structural instability at high pressures and temperatures, have been eliminated.

If you are planning on expansion or the addition of new power plant units, we suggest consideration of the Breech Lock design. Lunkenheimer representatives and engineers will be glad to work with you.



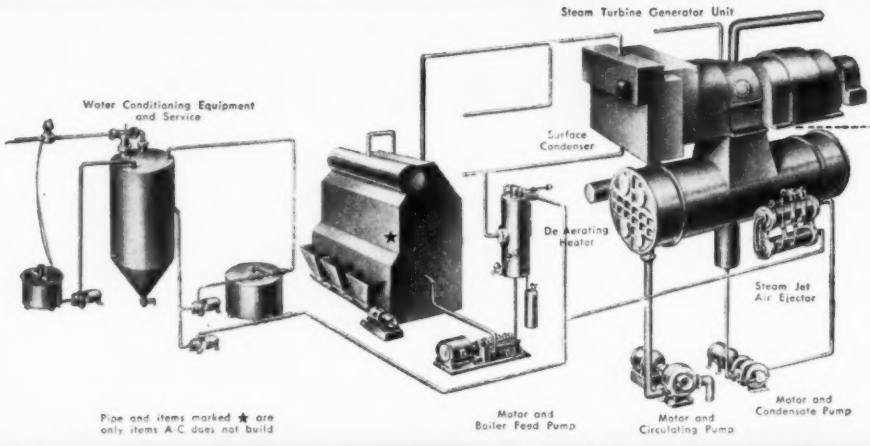
Bonnet fits into body and lugs intermesh with a 45° turn to mechanically lock the two parts together. Heavily proportioned lugs provide necessary strength to carry full internal pressure load acting against bonnet. Precision machining of each lug assures even stress and perfect alignment of stem and other valve parts. Leakage past the joint is impossible as outer joint is covered by a seal weld.

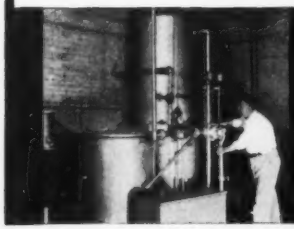
Breech Lock circular No. 552,
yours for the asking.

Write for Lunkenheimer Circular No. 552 which describes and illustrates Breech Lock Seal Welded Bonnet Cast Steel Valves. Also lists recommended body-bonnet casting materials for high pressure-high temperature services.

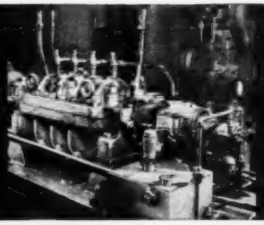
ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U. S. A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

All Along the


Steam Turbine Generator Unit
Water Conditioning Equipment and Service
Surface Condenser
De Aerating Heater
Steam Jet Air Ejector
Pipe and items marked ★ are only items A-C does not build
Motor and Boiler Feed Pump
Motor and Circulating Pump
Motor and Condensate Pump



3-WAY WATER CONDITIONING program — equipment, chemicals and service — is offered by Allis-Chalmers. Shown is a 7500 gal zeolite softener in feedwater cycle of a Wisconsin industry. Long steam turbine generating experience lies behind A-C water conditioning program.



PUMPS FOR ALL POWER PLANT purposes are built by A-C. Multi-Stage boiler feed pump shown rated 75,000 lb per hr, 550 lb press. in a power company heating system. Boiler Recirculating, Condensate Removal, Feedwater, Ash Sluicing, and other special designs are available.

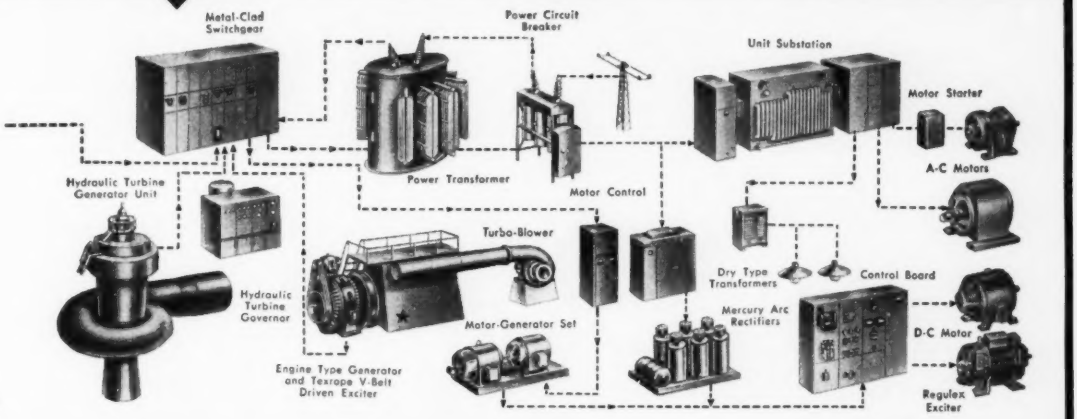
SPECIFY ALLIS-CHALMERS FOR QUALITY POWER EQUIPMENT!

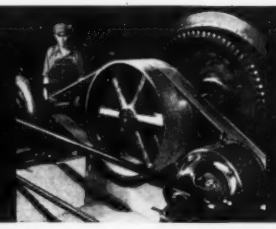
From Preventing Boiler Scale to Developing All-Weather Motors, Allis-Chalmers Knows Many of the Answers to Power Industry Needs!

Pioneers in Power and Electrical Equipment From Generation Through Utilization

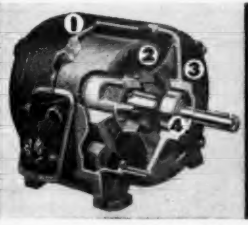
ALLIS-

A-C ALLIS-CHALMERS "Power Line"





TEXROPE MULTIPLE V-BELT drives for shock-free efficient power transmission were developed by Allis-Chalmers. Capacities from fractional to 6000 hp. operate at over 98% efficiency. Engine-type generator exciter drive shown has run 17 years without even a V-belt replacement.



SAFETY-CIRCLE MOTOR is protected all-around by close-grained cast iron stator frame and end bells from damage and distortion. ½ to 20 hp. 1) Cast iron SAFETY-CIRCLE frame 2) Multiple dipped, Multiple baked windings 3) Cast iron end bells 4) Factory lubricated, sealed bearings.

IF YOU WORK with the generation, transmission or utilization of electrical or mechanical power, you *know* the value of undivided manufacturer responsibility — as in a complete pump-motor-control "team," for example. No other company offers you as wide a range of inter-related equipment and undivided responsibility all along the "power line," as Allis-Chalmers!

And Allis-Chalmers excels, not only in range, but *quality* of equipment. A-C knows how to design and build *quality* component apparatus for power systems because it knows from 102 years of experience the *entire* electrical and industrial picture and what interacting conditions must be met. The next time you need a replacement or a new piece of equipment consider the A-C *quality* line.

Having a "coordinated" Allis-Chalmers system simplifies your maintenance problem in two ways: 1) Generously designed and skillfully built apparatus gives fewer power interruptions 2) Undivided responsibility provides "team" performance. Bulletins and specific information on any of the products on these pages may be secured from your local A-C representative or by sending the coupon to ALLIS-CHALMERS.

Texrope, Regulex and *Safety-Circle* are Allis-Chalmers trademarks.

A-C ALLIS-CHALMERS

CHALMERS

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

Please send me specific information on

_____

_____

Name _____

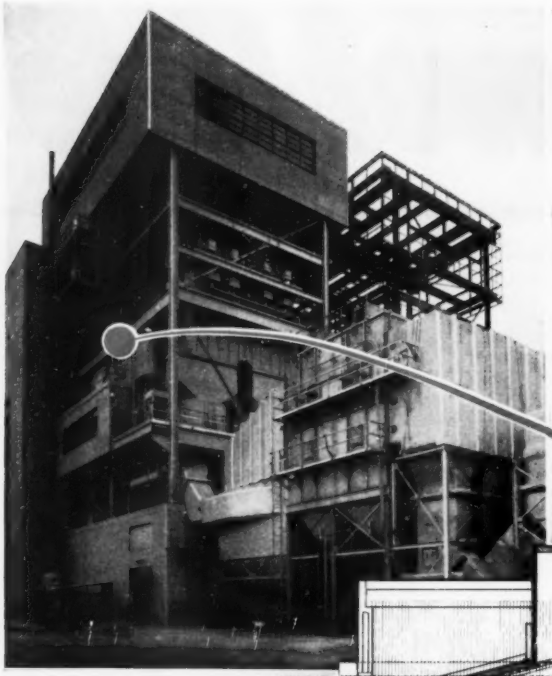
Company _____

Title _____

Address _____

City _____ State _____

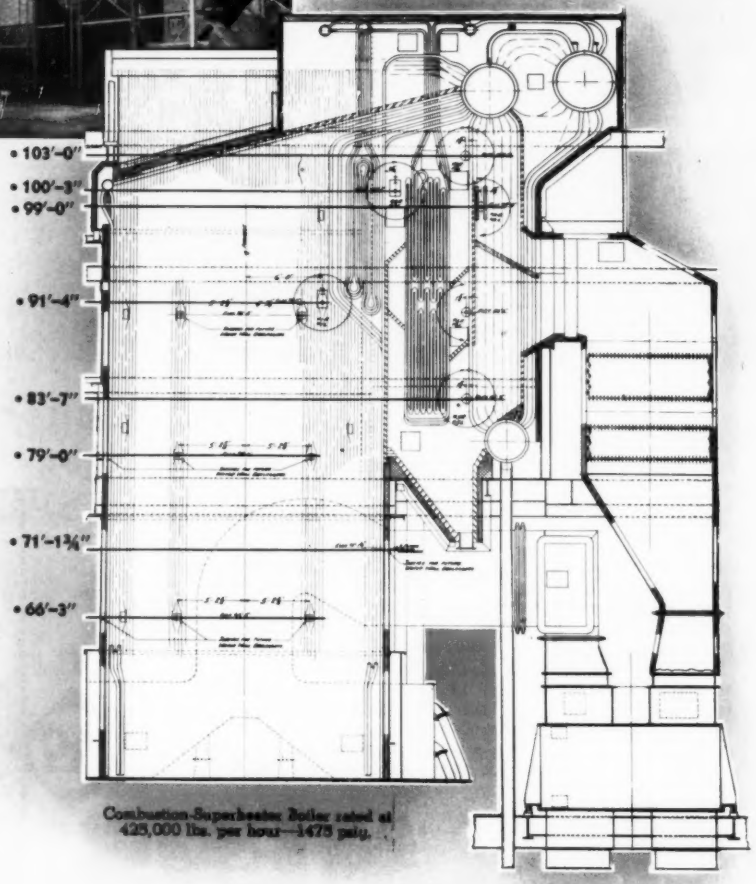
A-2740



VULCAN at Port Jefferson POWER STATION

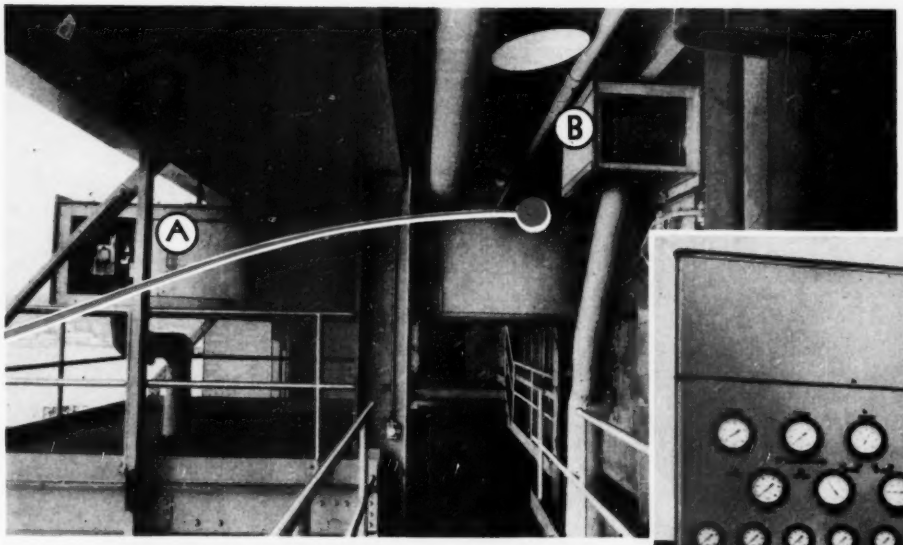
Long Island Lighting Co.

A DUPLICATE OF THIS VULCAN SOOT BLOWER SYSTEM HAS BEEN ORDERED



Combustion-Superheater Boiler rated at 425,000 lbs. per hour—1475 psig.

Automatic Sequential System



At "A" above—one of 4 Vulcan T-2's (long retracts). Each is completely covered for protection against the weather-yet accessible through removable and sliding panels. At "B" above—one of 14 Vulcan E-3 Rotary Blowers each protected by easily removed sliding panels.

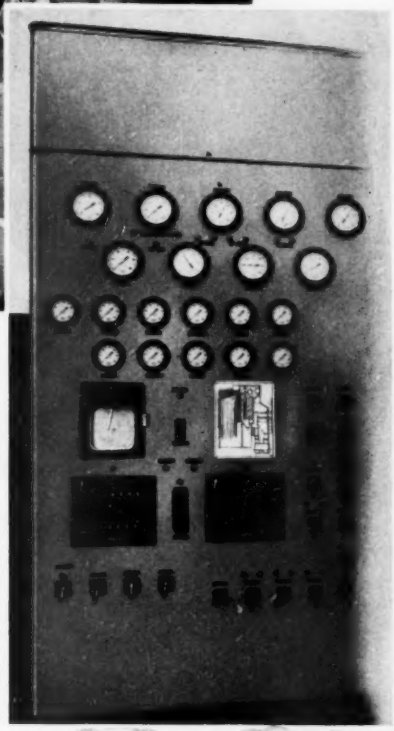
Most Northerly Outdoor Boiler Installation *in the* U.S.A.

Chosen for the farthest north outdoor installation in the U.S.A. the Vulcan Automatic Sequential (air operated) Soot Blower system at Port Jefferson consists of 4—T-2 Long Retractables; 14—E-3 Rotary units and controls for the air heater blowers.

The boiler is a Combustion-Superheater, rated at 425,000 lbs. steam per hour.—1475psig

Soot blower parts are constructed of corrosion resisting materials and equipped with weather hoods for protection against the elements. Specially designed in cooperation with Ebasco Services Inc.—weather hoods are—another Vulcan first.

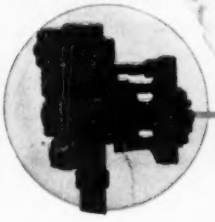
Flexible, compact and interlocked controls for the entire soot blower system are incorporated into the main boiler panel. Report back instruments give the operator a complete picture of soot blower operation. Nothing is left to chance.



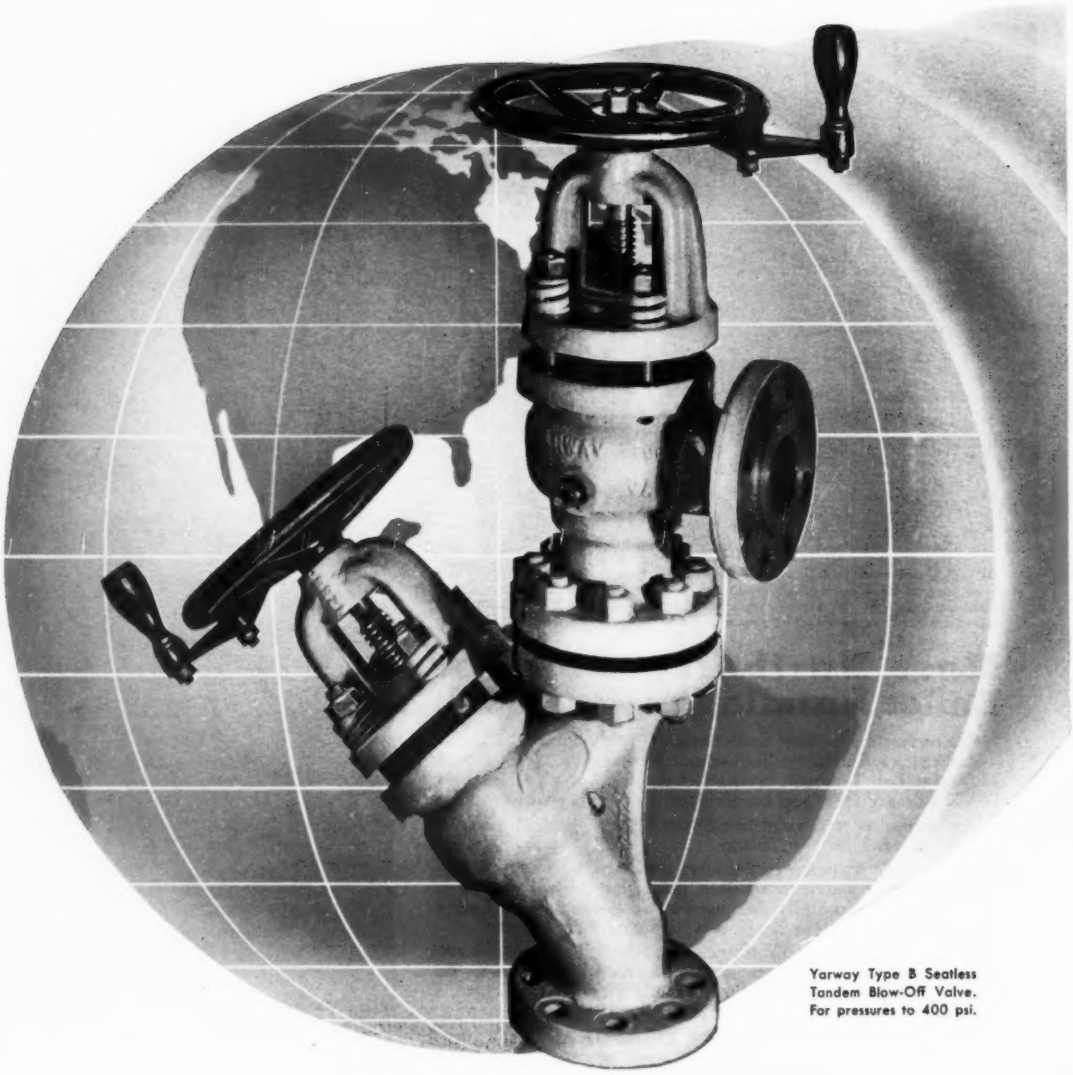
Vulcan flexible, compact and interlocked controls for the entire soot blower system are incorporated in the main boiler panel.

VULCAN SOOT BLOWER CORPORATION
DUBOIS, PENNA.
Division of—CONTINENTAL FOUNDRY & MACHINE CO.

VULCAN
STEAM OR AIR



SOOT BLOWERS



Yarway Type B Seatless
Tandem Blow-Off Valve.
For pressures to 400 psi.

YARWAY

THEY KEEP BLOW-DOWN LINES TIGHT IN OVER 15,000 PLANTS

Yarway Blow-Off Valves are known in almost every plant where boilers are used to generate steam.

Why this thorough acceptance? Partly because the Yarway *Seatless* feature eliminates the commonest source of blow-off valve trouble. In Yarway *Seatless* Valves there are no seats to score, wear, clog and leak.

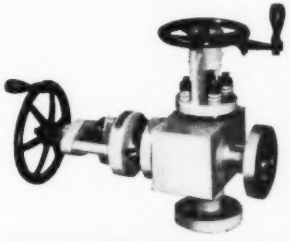
Partly because of Yarway's advanced designs—such as the Unit Tandem for high pressure work. This valve combines a Yarway *Stellite-Seat* Valve (for blowing) with a Yarway *Seatless* Valve (for sealing) in a solid, one piece forged-steel body.

And finally the dependable, trouble-free service of Yarway Blow-Off Valves prompts power plant engineers to insist on Yarways.

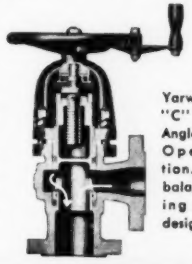
Regardless of the reason, the fact remains that today Yarway Valves are on the job—doing a good job—in more than 15,000 plants. How about yours?

Write for Bulletin B-424 for pressures to 400 psi. For higher pressures ask for B-432.

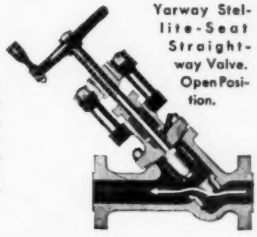
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Penna.



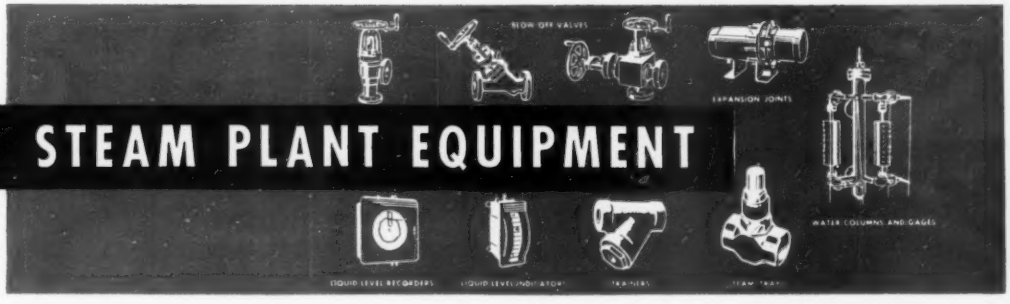
Yarway Unit Tandem Blow-Off Valve. Flanged type. Also available with welding ends. For pressures up to 2500 psi.



Yarway Type "C" Seatless Angle Valve. Open position. Notice balanced sliding plunger design.



Yarway Stellite-Seat Straightway Valve. Open Position.



INVESTIGATE
The Public Utility STOKER

Detroit RotoGrate is an advanced design of spreader stoker with forward moving grates that discharge the ash at the *front*. Intermittent cleaning of the fires and disturbance of uniform combustion is eliminated.

That's Why It:

1. **Burns any Bituminous Coal or Lignite with high efficiency.**
2. **Requires no special fuel preparation.**
3. **Permits high burning rates—increases capacity.**
4. **Maintains high CO_2 with or without preheated air.**
5. **Operates without clinker difficulties or slagging in the furnace.**
6. **Combustible loss in the ash pit is low.**
7. **Handles fluctuating loads—responds quickly to sudden changes.**
8. **High availability is assured.**

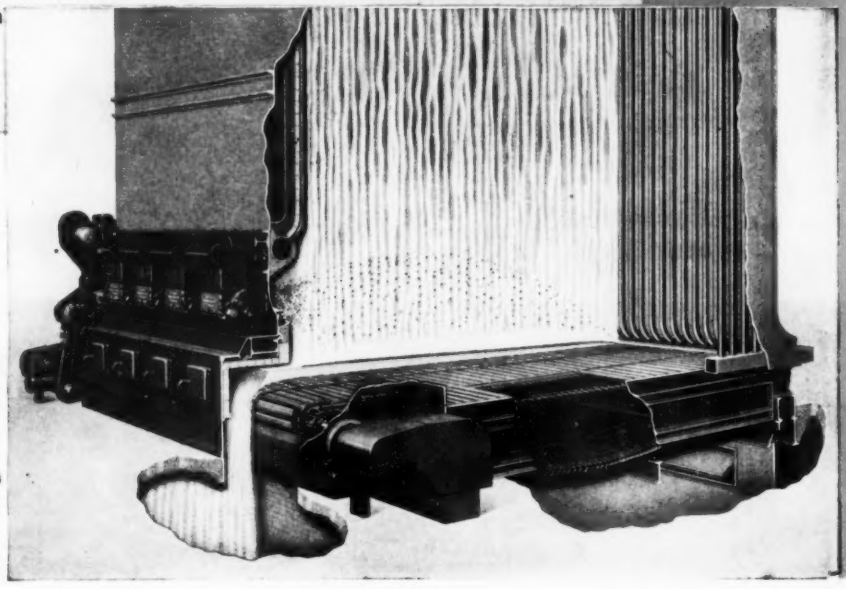
Northern States Power
Five Contracts—Four plants
Wilmarth—Lawrence—
French Island—Red Wing

Central Illinois
Electric & Gas
Fordam and
Substation Stations

Ohio Public Service
Mahoningside

Central States
Electric

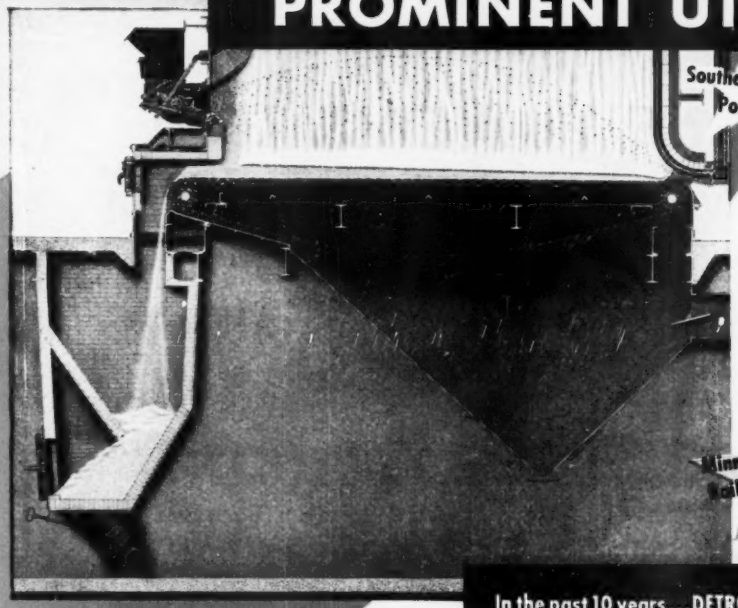
Central Iowa
Power Cooperative



DETROIT ROTOGRATE

selected by these

PROMINENT UTILITIES



Southern Utah Power

Missouri Public Service

Sioux City Gas and Electric Kirk Station

Minneapolis Street Railway Company

In the past 10 years... DETROIT ROTOGRATE STOKERS have revolutionized coal burning. Ask any user.

Otter Tail Power Breat Lake Station

Public Service Company of Oklahoma

Montana-Dakota Utilities Two Plants

Black Hills Power and Light

Lake Superior District Power Bay Front Station

Indianapolis Power and Light Perry W Station

Iowa Public Service Six Contracts Five Plants

DETROIT ROTOGRATE STOKER

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

WORKS AT MONROE, MICHIGAN • DISTRICT OFFICES IN PRINCIPAL CITIES

KVS

FINE PULVERIZATION
Provides Rapid Combustion
with
KVS Air Swept Tube Mills

Air passing through the mill floats out superfine, carbureted fuel.

Preheated air in desired quantities is drawn through the mill by a variable speed fan, removing only the impalpable powder, automatically controlling fineness of pulverization.

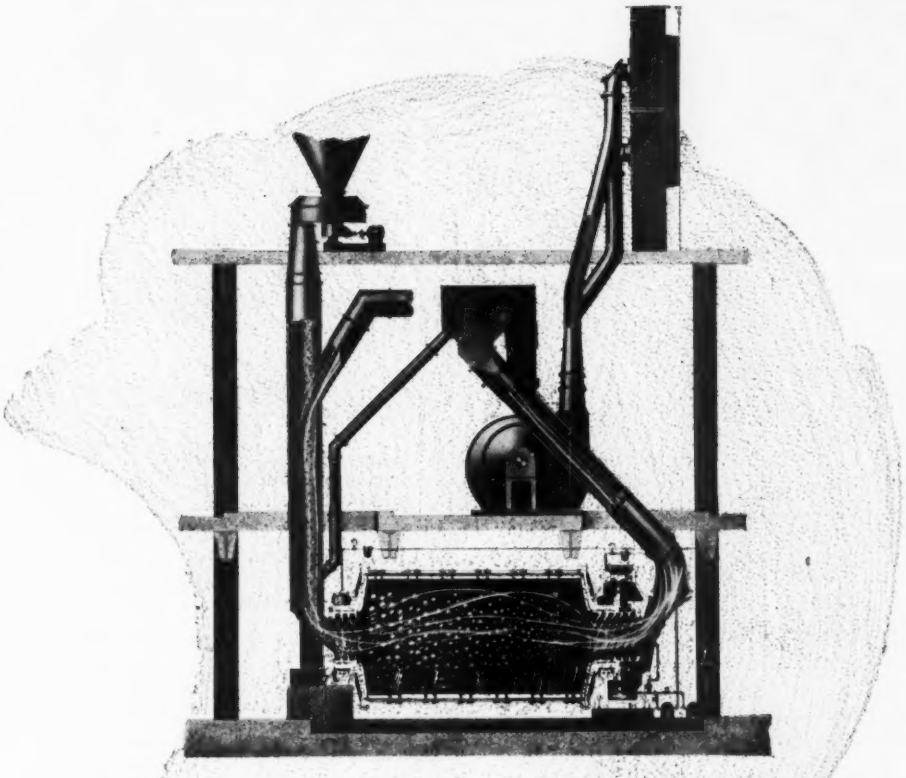
Coal is ground in air and collected by air. Oxygen and carbon combine to provide, in effect, a highly combustible gas for delivery to the combustion chamber.

Moisture in the coal is released by hot air passing through the mill. Coal containing from 5% to 15% moisture is fired without the use of a separate dryer, directly from the mill without storage in bins or hoppers.

No magnetic separator is used. Tramp iron cannot damage KVS Air Swept Tube Mills but instead acts as grist and actually helps grind coal in the same manner as the Herculite balls.

KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK · USA · MFG. & ENG. CORP.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
ARMY E NAVY
2 PARK AVENUE • NEW YORK 16, N. Y.
FACTORIES: DANVILLE, PA.
CANADA • ENGLAND • FRANCE • AUSTRALIA



KVS Air Swept Tube Mills are slow speed machines. Within the slow-speed range, mill speed is predetermined to carry the grinding balls high on the mill periphery. From the high point of carry the ball charge is thrown down on the coal in a continuous cascade. Fine pulverization results from the hammer-and-anvil effect of thousands of blows per minute on coal particles against XX Herculite mill liners. Ball wear from this impact is at a minimum rate.

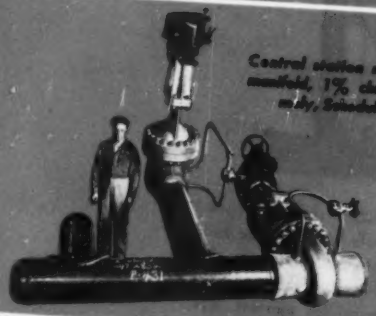
99% availability—and better—contributes materially to low operating cost.

A continuous, dependable reserve of superfine coal is prepared, regardless of the quality of coal available.

All other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels for high operating efficiency and a maximum of economy at all boiler ratings.

Section of 12" alloy steel all-welded main steam line for 900 psi working steam pressure.

Pump discharge header for glass furnace circulating water system.



Central station main steam manifold, 1¼ chrome, ½% moly, Schedule 160.

8" triangular manifold connections for oil refinery piping.

Bleeder piping manifold for steam turbine fabricated from 24" and 20" pipe and Midwest Welding Fittings.

YOU SAVE Time and Money IN ERECTION by Using MIDWEST PREFABRICATED PIPING

Midwest Prefabricated Piping is precision piping . . . that is why it saves time and reduces the cost of field erection. Being contractors as well as fabricators, we know from long experience the importance of having the subassemblies accurate to dimension and alignment. Before shipment from any of the four modern Midwest shops, pieces are checked for dimensional accuracy and thoroughly cleaned to remove scale and dirt by turbinizing or acid pickling as may be specified. Careful inspection and pressure testing are other characteristics of Midwest Prefabricated Piping methods.

Another important reason for the ease of erection and economy of Midwest piping is the fact that the difficult operations are performed in the fabricating plant and field welding is simplified. Here again our extensive erection experience enables us to effect savings by locating field joints where they are easy to make.

You will find it to your advantage to use Piping by Midwest . . . it saves time, money and trouble.

MIDWEST PIPING & SUPPLY CO., Inc.

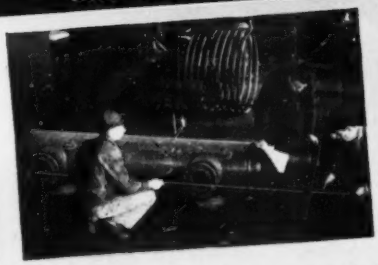
Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and South Boston • Sales Offices: New York 7—30 Church St. • Chicago 3—79 W. Monroe St. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. South Boston 27—426 First St.

4 PLANTS ARE BETTER THAN 1

3478

CHECKING DIMENSIONS AND ALIGNMENT



The careful check given every prefabricated subassembly before it leaves any Midwest shop saves time and trouble in field erection.

THOROUGH CLEANING

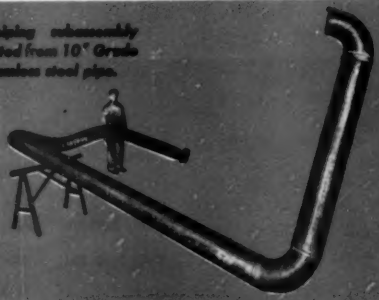
Prefabricated subassemblies are thoroughly cleaned before shipment from any Midwest plant and are turbinized when specified.

CAREFUL TESTING

All Midwest plants have complete facilities for testing piping assemblies to assure their ability to withstand the most severe operating conditions.

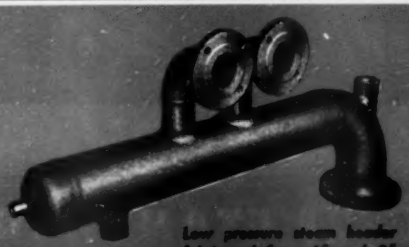
Main steam piping prefabricated from Schedule 120 carbon-moly alloy steel pipe.

Process piping subassembly prefabricated from 10" Grade "A" seamless steel pipe.



Header for natural gas pipeline tested to 1400 psi.

Prefabricated subassembly of 24" OD x ½" wall seamless steel pipe for oil refinery.



Low pressure steam header fabricated from 6" and 3" pipe and Midwest Welding Fittings.

These turbine lubrication savings

can be yours

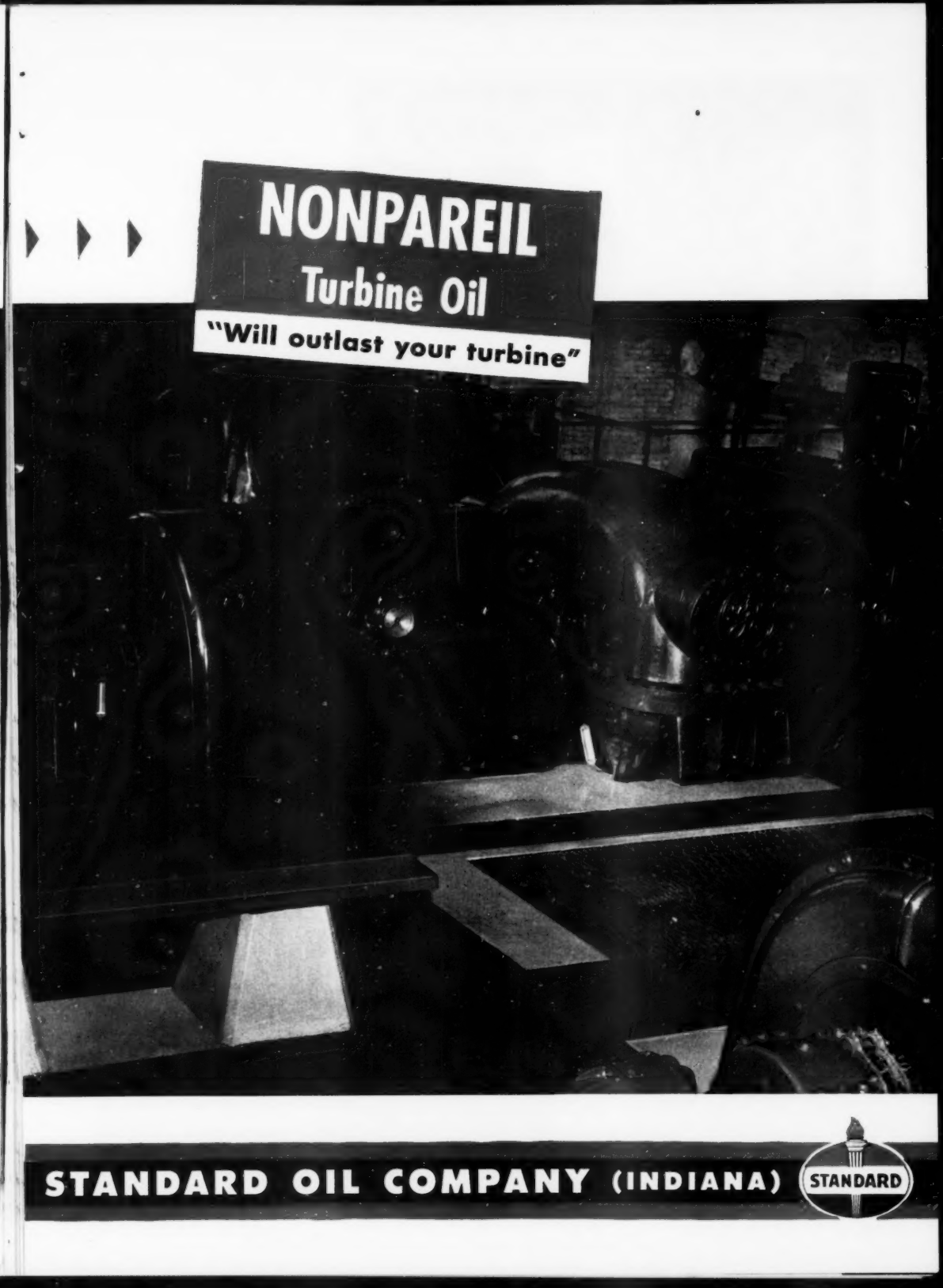
SIMPLY by your choice of turbine oil, you can eliminate the cost, the time and the labor of replacing turbine oil. You can eliminate also the need for removing turbine oil for treating and the need for cleaning oil systems. Evidence that you can make these savings is supplied by S. H. Smith, superintendent of the Board of Public Works, South Haven, Michigan. He reports:

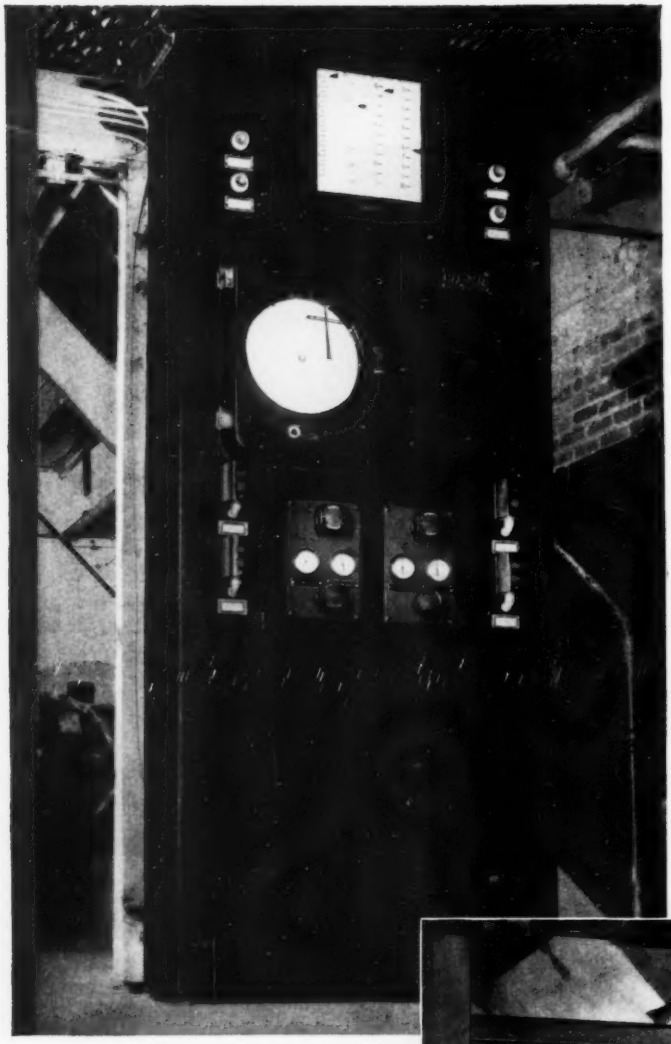
"When the first of our three present turbines was installed in 1936, we filled it with Nonpareil Turbine Oil. This practice was followed with each of the other two turbines. *In 13 years' use of Nonpareil, we have had no shutdowns resulting from dirty oil or from the necessity of replacing oil.* It has not been necessary to clean the oil. Semi-annual tests have shown that the oil has not deteriorated in any way."

Your switch to Nonpareil Turbine Oil will insure safe and economical lubrication, not only for 13 years, but for the *life* of your turbines. You receive with each fill of Nonpareil a written guarantee that the oil will last as long as the turbine and that its acidity will stay below a neutralization number of 0.15 mg. KOH/gm. Find out from a Standard Oil Lubrication Engineer how Nonpareil has lived up to its guarantee, how it has reduced utility lubrication costs as much as 68%.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

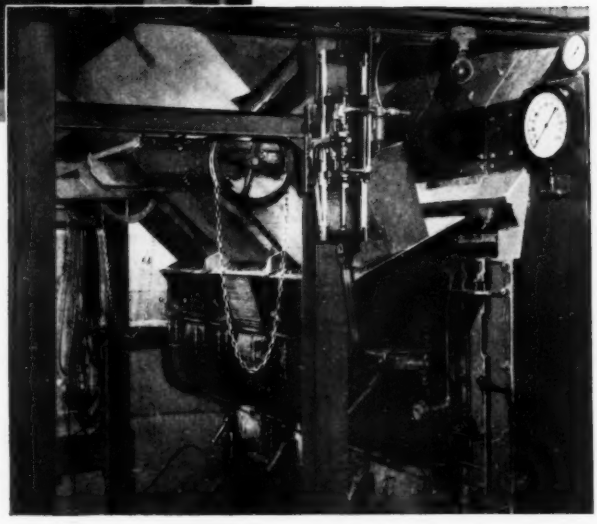
STANDARD OIL COMPANY (INDIANA)


NONPAREIL
Turbine Oil
"Will outlast your turbine"
STANDARD OIL COMPANY (INDIANA)
STANDARD



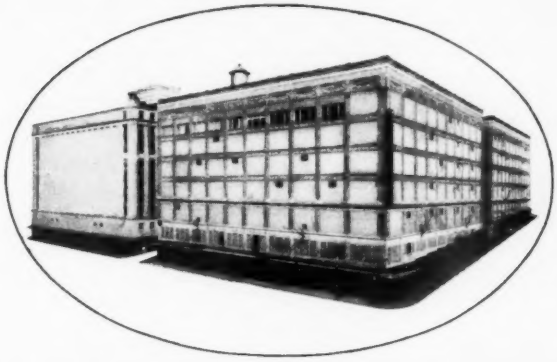
Control panel of the new boiler at F. & R. Lazarus & Co., Columbus, Ohio, showing Hagan Ring Balance Boiler Meter.

then,



View of front of boiler. Hagan fuel control cylinder is shown in foreground. Boiler was installed by the manufacturer, Combustion Engineering Corporation. Edward E. Ashley of New York was consulting engineer.

The main buildings of F. & R. Lazarus & Company occupy a full city block. Steam is used primarily for heating, but some is required for laundry and cooking.



First, HAGAN CONTROLS, HAGAN controls and meters

AT F. & R. LAZARUS & COMPANY

The store of F. & R. Lazarus & Company in Columbus, Ohio—now managed by the fourth generation of the Lazarus family—would do credit to any city. Its main buildings now occupy a full city block, and additional buildings are used for special departments and services.

These main buildings represent an almost constant program of construction and modernization, which has been accompanied by necessary changes in the steam generating plant.

Hagan Control—a master sender, compensating relay, receiving regulators and balanced float controllers—was installed on two boilers in 1944.

Continued expansion of the store made further modernization of the boiler plant necessary, and in 1949 a new boiler was installed. This is stoker fired, has a capacity of 31,500 lb./hr. and operates at a pressure of 125 psi.

Hagan Automatic Combustion Control was installed on this new boiler, and a separate panel was provided. A Hagan Ring Balance Boiler Meter measures steam flow and air flow.

Both Hagan Controls and Hagan Ring Balance Meters are characterized by simplicity, accuracy and dependability. Because of these qualities they are giving eminently satisfactory service in steam generating plants of all types and sizes, in all parts of the country.

For full information on either Hagan Ring Balance meters or Hagan Automatic Combustion Control, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

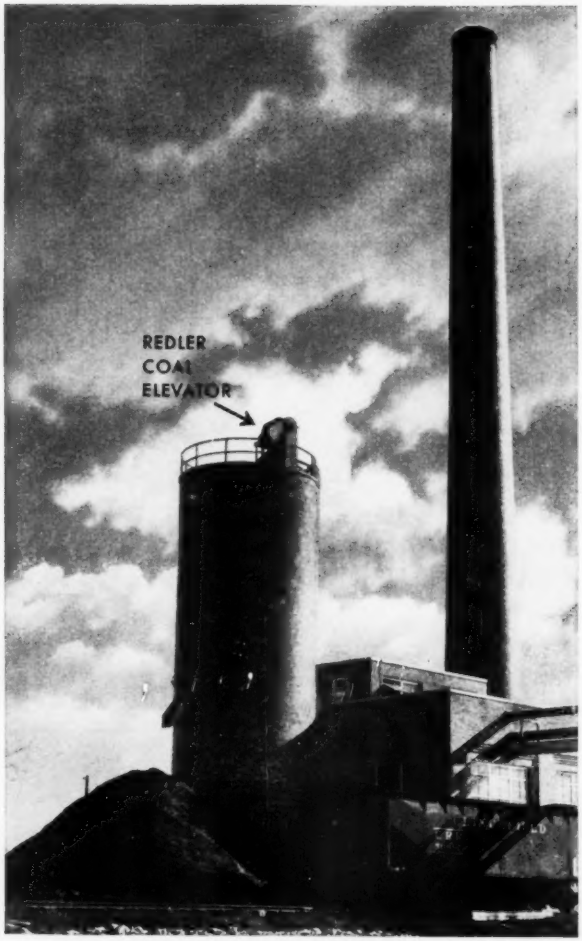
HAGAN HALL BUROMIN CALGON

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

2 JUMPS AHEAD

—even of ol' Man Winter



Fast, clean, low-cost-per-ton handling of coal by means of a Stephens-Adamson designed system keeps this power plant always two weeks and 200 tons ahead the year around. Coal moves from track hopper directly to silo which holds a two-week supply under winter steam loads.

For nearly half a century, S-A engineers have designed and installed bulk materials handling systems for almost every kind of industry. This broad experience enables them to recommend an efficient conveyor system for even the most difficult bulk materials handling job . . . a system that will handle maximum tonnage at lowest cost per ton.

Whether you plan to improve your present coal or ash handling system or install a completely new one, take advantage of the years of experience of S-A engineers. Their recommendations will not obligate you in any way. Write today.

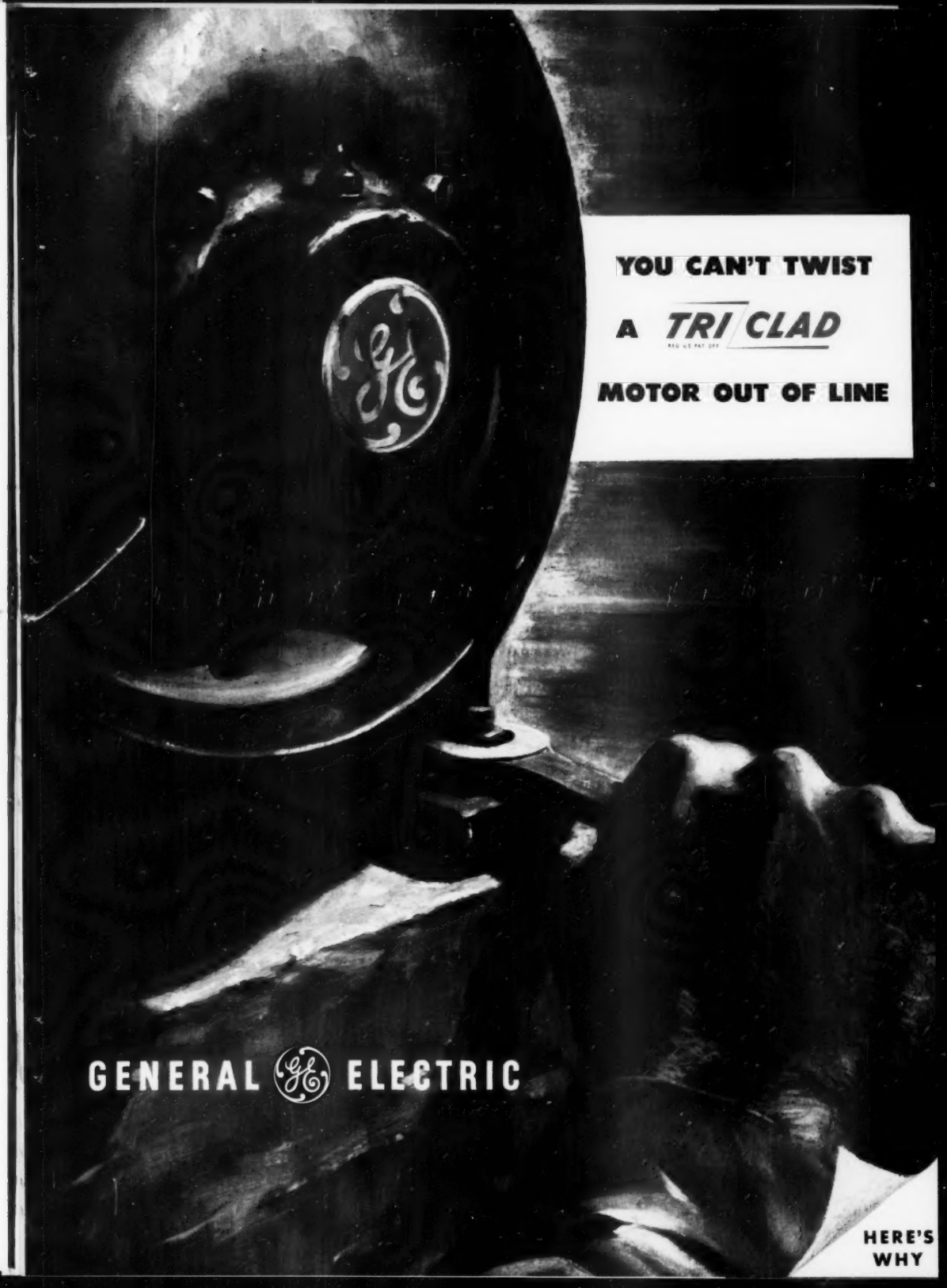
HOLLISTON MILLS OF TENNESSEE
KINGSPORT, TENNESSEE

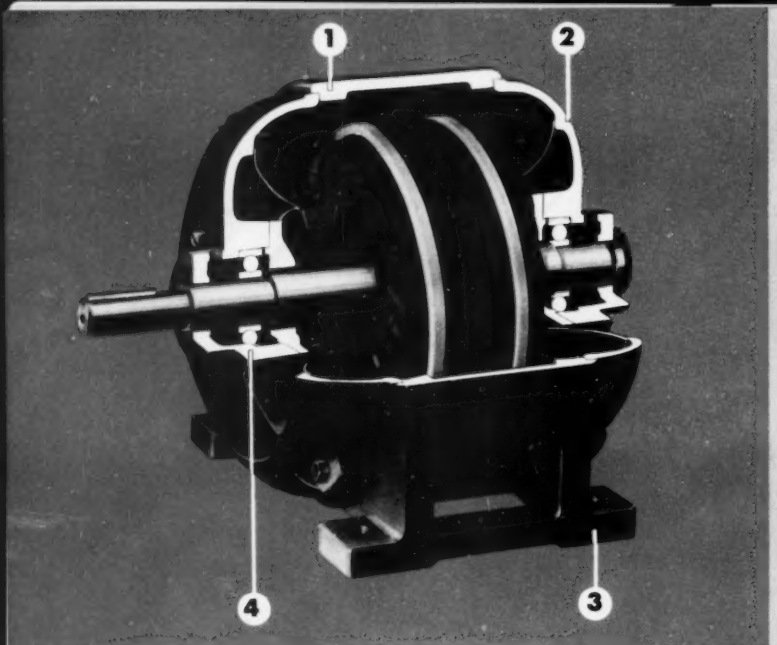
Pan feeder draws coal from track hopper and feeds to loop boot section of 72 foot high REDLER elevator. Oversize lumps are fed into a KNITTLE ring-type crusher and returned to loop boot of elevator. TELLEVEL storage control unit automatically stops coal feeder and elevator when silo is full. Five foot extension of REDLER elevator above silo simplifies inspection and maintenance. Surplus coal is placed outdoors and is easily reclaimed as needed. Capacity of handling system . . . 25 tons per hour.

STEPHEN S-A DAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT


YOU CAN'T TWIST
A TRI CLAD
MOTOR OUT OF LINE
GENERAL ELECTRIC
HERE'S
WHY



Look at the solidity of a Tri-Clad's thick-section cast-iron frame (1) and heavily reinforced end shields (2) . . . its heavy integrally cast feet (3). Do you wonder we say "Tri-Clad gives you structural strength and rigidity no other general purpose motor can match"? Notice, too, the *completely* enclosed bearings (4). A Tri-Clad motor will run safely without relubrication for years — as long as any general-purpose motor you can buy. Yet it's grease-gun easy to lubricate if you ever need to.

You can't twist a *TRI CLAD* motor out of line

Try as a heavy-muscled mechanic may, he can't twist a Tri-Clad motor frame when bolting it to an uneven surface. The bolt will snap before he can pull that rigid cast-iron structure out of line.

Important? It's one of the basic reasons General Electric believes cast iron to be the ideal structure for general-purpose industrial motors. Other reasons? Cast iron has unusually high resistance to rust and corrosion. It has an inherent damping action that minimizes resonance. And . . . it won't take on an injurious permanent "set" as a result of accidental blows or mechanical abuse.

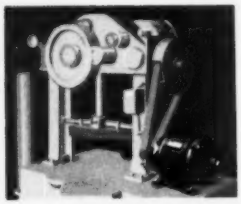
Want a motor that's been **SERVICE-PROVED** in 5 billion hours of rugged industrial use? Nearly all types and ratings are **AVAILABLE FROM STOCK.**

Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

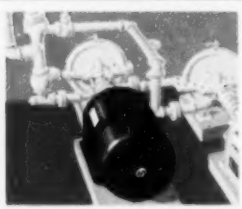
GENERAL ELECTRIC

750-TB

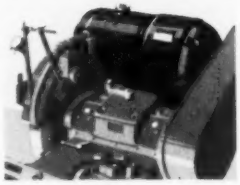
YOU CAN'T BEAT *TRI CLAD* EXTRA PROTECTION



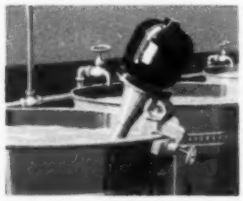
G-E open (drippproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.



G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.



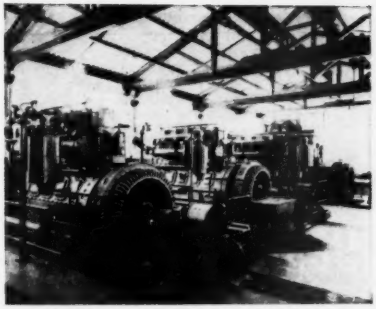
G-E Type ACA induction motors for adjustable speeds—provide 3 to 1 speed range. From 3 to 75 hp.



G-E flange and face-type motors for use where the machine supports the motor, or vice versa. From 1/20 to 60 hp.

Look for this **EXTRA** on the motor you buy!

How Brasil Oiticica and Worthington Solved a Vital Power Problem



Two Worthington CC-5 Diesels and one CC-8 Diesel at Brasil Oiticica, Fortaleza, Ceara.

When imports of tung oils from the Orient stopped during the war, a critical condition arose in the manufacture of paints and varnishes.

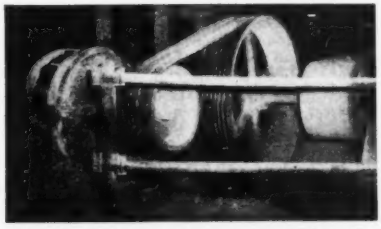
In the early 1930's, the Brasil Oiticica Company had begun to develop a substitute for tung oils known as oiticica oil. Oiticica oil is obtained from nuts of forest trees in northern Brazil. It was economically desirable to treat the crude oil at the source of supply, which created the problem of establishing and maintaining an efficient power plant. A reliable source of power was needed to prevent the disastrous solidifying of the oil in pipes and machinery, which occurs after power failure.

To avoid the consequences of the power failure, Brasil Oiticica Co. engaged Worthington do Brasil to install a Diesel power plant, placing an order for three Diesel engines and three generators. Mr. M. E. Marvin, president of Brasil Oiticica Co., selected Worthington to do the job because he believed that Worthington equipment would meet his rigid requirements for continuous operation.

In building the power plant another problem arose, because the Brasil Oiticica factory is located near the Atlantic Ocean where the water level is very close to the solid ground. The load-bearing quality of the soil is low in this area, and it was necessary to construct a special foundation to support the entire Diesel station. This foundation, designed by Worthington, consists of a large concrete mat in which there is space for four Diesel generators. The cranes and other construction materials which Brasil Oiticica Co. had ordered, were shipped in advance of the main equipment to facilitate the early finishing of the foundations and the construction of the power plant. When the machinery and generators were shipped, Worthington do Brasil supplied a field superintendent to supervise the installation and to instruct plant personnel in the correct methods for operating the equipment.

The power plant was put into continuous operation on March 1, 1947 and has operated satisfactorily since that time. It had operated 15,823 hours and had generated 2,347,800 kwh as of August 1, 1948.

V-Belt Drive Dusts Off 20 Years



Worthington V-Belt Drive at W. G. Bush & Co.'s Nashville, Tennessee mill.

At the W. G. Bush & Co. brickyard in Nashville, Tenn.—one of the largest in the South—a Worthington Multi-V-Drive is used to power line shafting which runs the pug mill and the conveyors.

The pug mill works the clay; the conveyors move bricks from die to loaders.

Despite the obviously dusty conditions, this drive has been operating a full day every day for twenty years without a breakdown, and the original set of belts is still in good condition.

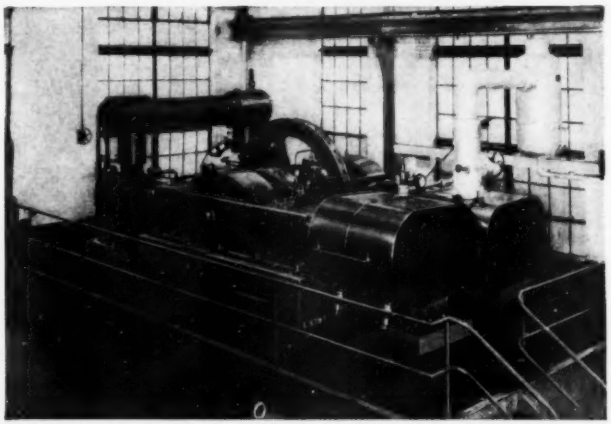
The belts are powered by a 125 hp motor, operating at 895 rpm, and run over sheaves of 24 in. and 60 in. PD.

NEWS

FROM THE POWER FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

No Hole in the Wall Needed to Get Air



This is the type of Worthington air compressor used in the spark plug plant referred to in the story.

A large spark plug manufacturer likes compressed air because it is most suitable to the special nature of the operations in the plant, is a clean type of power, and keeps production at a top level.

The management selected Worthington air compressors because of their heavy-duty slow-speed characteristics, resulting in long life. These units are steam-driven. Preventive maintenance keeps them in top-notch shape.

The air compressors are located in a room which is so packed with air compressors that it would necessitate removing part of a brick wall if a piston rod had to be removed from a unit. But the performance of the Worthington machines has been such that no masonry work has ever been required.

And no work stoppage has ever been charged to lack of air.

Worthington 4-CF-1 pump at Buffalo Pottery, Inc., Buffalo, N. Y.

Mixing Multiplied By 4

Blunging, in a pottery, is the process of mixing various types of clay together in water. The quality of the china depends upon the quality of the mixture.

The conventional blunger is an oval-shaped pit in which propeller-type agitators are rotated while various proportions of clays are added to the mixture.

At Buffalo Pottery, Inc., manufacturers of a high-quality hotel and restaurant dinnerware, the blunging operation was falling behind the rates of production in other departments which had been modernized, and a speed-up was called for.

Loading and blunging a 6,000 lb batch took 2½ hours, using a 15-hp motor, and the final specific gravity was limited to 1.46 maximum. The average specific gravity of the clay added is 2.5. This results in a fairly thick mixture.

Installation of a Worthington 4-CF pump to replace the propeller-type mixers reduced the blunging time to 1¼ hours and made possible increasing the load to 8,000 lbs with a final specific gravity of 1.52, and at the same time decreased the power requirement to 8 hp.

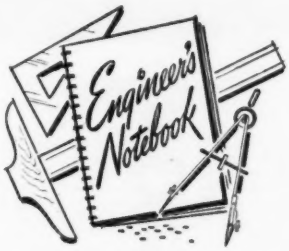
Installed in a pit next to the blunger, the pump serves as a circulator for the blunger and also to transfer the mix from the pit to storage prior to filtering.

There has been a decrease in the time required to load and unload, and also in the filter pressing operation, resulting in an overall production increase of approximately 400%. Furthermore, the quality of the slip has been tremendously improved.

City water is supplied to the seal cage in the stuffing box and the pump is protected from possible damage by tramp iron by the installation of a magnetic trap in the suction line. A suction strainer had been tried, but it was found that the slip was so thick that the strainer readily plugged. The success of the operation has been proved by a full year of service.

Worthington Pump and Machinery Corporation
Harrison, N. J.

NEWS



Steam Turbine Types and Applications

Steam turbines are divided into two types of drives: Generator-Drive Turbines, those used to drive A.C. or D.C. Generators; and Mechanical-Drive Turbines, those used for driving any piece of apparatus other than generators.

Basically, all turbines can be divided into two classes: Condensing, those that exhaust below atmospheric pressure; and Non-condensing, those that exhaust to a pressure equal to, or greater than, atmospheric pressure. A turbine, however, is a very versatile piece of machinery and many modifications can be made to these two basic designs in order to get the most economical installation.

For powers up to 500 kw or 750 hp, usually either of the two basic classes of turbines, that is, condensing or non-condensing, will prove economical. However, higher loads may warrant the consideration of one or the other of the two basic turbines with modifications such as: Automatic Extraction (Bleeder), Mixed Pressure, Mixed-Pressure Extraction, or Double Extraction.

These modifications of the basic classes are described as follows:

1. *Automatic Extraction Turbines* include a device (or devices, in case of Double Automatic Extraction) for controlling the pressure of the steam extracted (or bled) from the turbine by regulating the flow of steam to the turbine stages below the extraction opening.

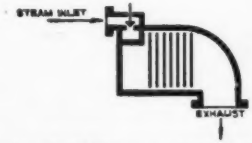
2. *Mixed-Pressure Turbines* are provided with separate inlets for steam at two or more pressures and have one or more devices for controlling the secondary steam inducted into the turbine by regulating the flow of steam to the stages below the induction opening.

3. *Mixed-Pressure-Extraction Turbines* combine the features as described in 1 and 2 above.

Schematic sketches with the most common uses of the various turbines are shown below.

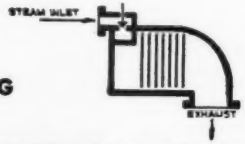
B-13

CONDENSING



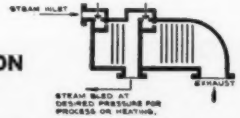
Used when exhaust steam from the turbine cannot be utilized and power must be generated on a minimum amount of steam.

NON-CONDENSING



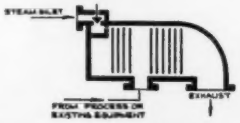
Used when all or practically all the exhaust steam from the turbine can be used for process or heating.

SINGLE EXTRACTION



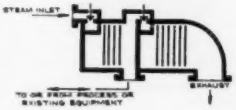
Used when process steam requirements are variable or intermittent. (A non-condensing extraction turbine can be used when process steam is required at two different pressures.)

MIXED-PRESSURE



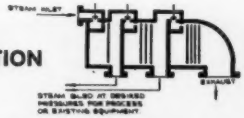
Used when there is excess steam available at lower-than-inlet pressure and when this supply is intermittent.

MIXED-PRESSURE-EXTRACTION



Used to supply process steam when necessary and to utilize a surplus of process steam when available.

DOUBLE EXTRACTION



Used when process steam is required at two different pressures (or at three different pressures if non-condensing).

That's right! POWELL VALVES

Fig. 19084 W. E.—Class 900-pound Cast Steel Pressure Seal Globe Non-return Valve with welding ends. Toggle operated. Improved streamline design reduces pressure drop and turbulence to the minimum.

Fig. 1708—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable, specially heat treated stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze disc. →

Fig. 500—125-pound Bronze Gate Valve with screwed ends, screwed-in bonnet, inside screw rising stem and tapered solid wedge in sizes ¼" to ¾", inclusive; double wedge in sizes 1" to 3", inclusive.

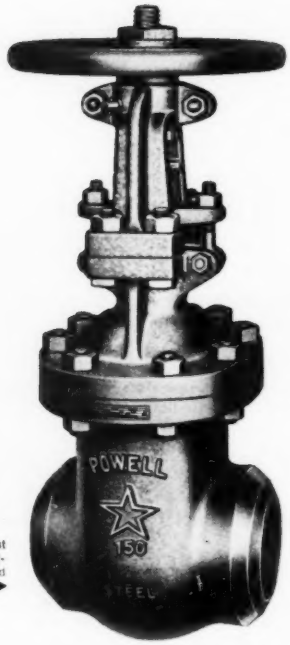
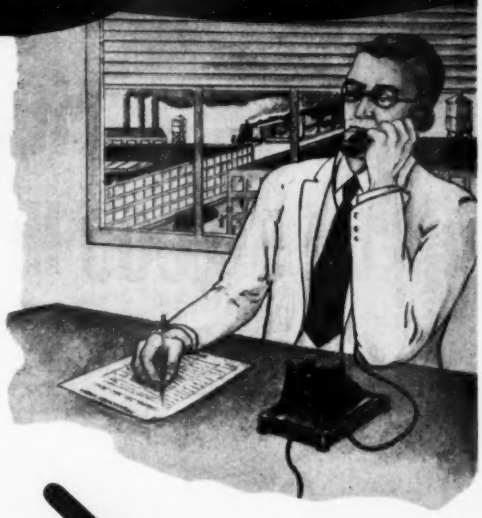


Fig. 1503 W. E.—Class 150-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge. →

POWELL

really cut maintenance costs



Every day, *the cost of production* is becoming a more important factor . . . and *maintenance* is a major item.

Take, for example, the cost of maintaining flow control equipment. By installing Valves that are properly designed and made of materials best suited to meet the exacting requirements of the service in which they are to be used, you not only save in the amount of wages paid out to maintenance crews, but you avoid costly shutdowns with consequent loss in production.

To build valves that give longer, trouble-free service has always been and is a prime consideration of Powell Research and Engineering. That's why it pays to standardize on *Powell Dependable Valves*. Ask your nearest Powell Valve Distributor—or write direct.

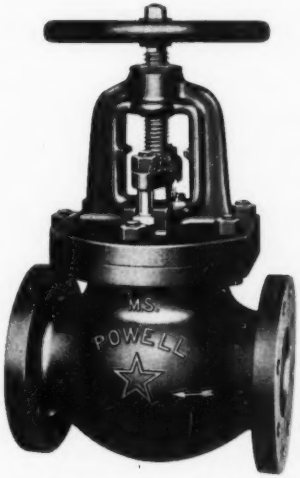


Fig. 241—Large 125-pound Iron Body Bronze Mounted Globe Valve. Sizes 2" to 16", incl. Has outside screw rising stem, bolted flanged yoke and regrindable, renewable bronze seat and disc.

Fig. 1314-A—Class 1500-pound Steel "Y" Valve. Has integral bonnet and welding ends.

Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve. Flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc. Disc, when wide open, permits full, unobstructed flow through valve body.

Powell Valves are made in Bronze, Iron, Steel and a wide selection of Corrosion-Resistant metals and alloys. Valves of every type—Globe, Angle, Gate, Check, Non-return and Flush Bottom Tank Valves—are included in the Complete Powell Line.

The Wm. Powell Company, Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES

For capacities up to 50,000 lb of steam per hr—

If your steam requirements are between 10,000 and 50,000 lb per hr, the C-E Vertical-Unit Boiler, Type VU-10, was designed for you. Simplicity of operation, efficient day in and day out performance, ease of maintenance and modest first cost combine to make the VU-10 particularly advantageous for moderate sized plants with limited operating personnel.

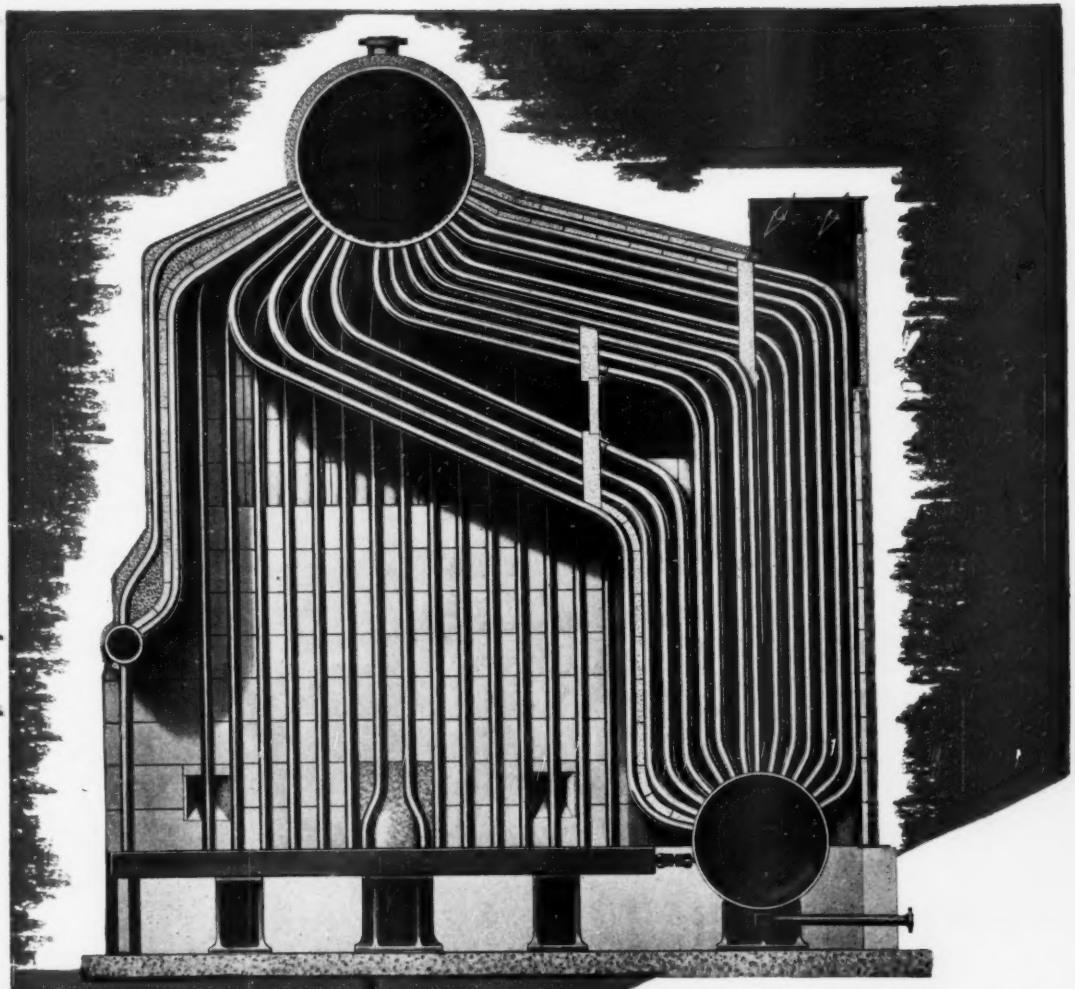
Every component part of this unit is not only designed for its own specific function, but is carefully coordinated with every other related part. This balanced design produces exceptionally flexible operation — efficiency over a wide range of output, ability to take rapid load swings and the assurance of satisfactory steam quality at all ratings.

Moreover, there are available five basic methods of firing — spreader stoker, single-retort underfeed stoker, chain grate stoker, or oil or gas burners — which permit you to choose the one best suited to the fuel and load conditions of your plant.

If you are planning the purchase of a steam generator, it will pay you to investigate the VU-10 Boiler. Our engineers will welcome the opportunity to discuss the matter with you at your convenience.

B-220

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS, ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

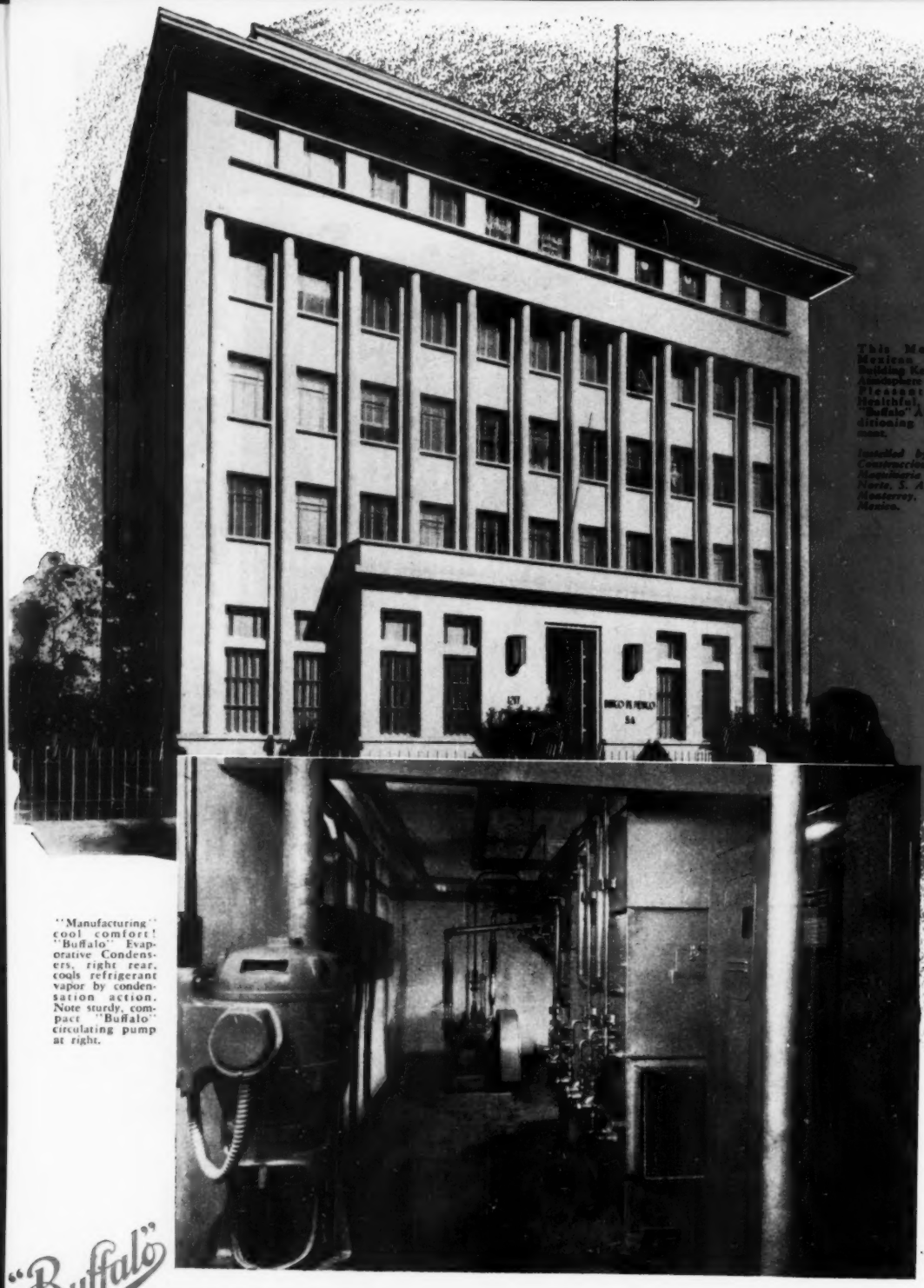


THE C-E
VERTICAL
UNIT
BOILER
TYPE VU-10

C-E COMBUSTION ENGINEERING—SUPERHEATER, INC.

A [illegible]TION ENGINEERING COMPANY, INC. and THE SUPERHEATER COMPANY

200 MADISON AVENUE
NEW YORK 16, N. Y.



This Modern Mexican Bank Building Keeps Its Atmosphere Cool, Pleasant and Healthful With "Buffalo" Air Conditioning Equipment.

Installed by Construcciones y Maquinaria del Norte, S. A. Monterrey, Mexico.

"Manufacturing" cool comfort! "Buffalo" Evaporative Condensers, right rear, cools refrigerant vapor by condensation action. Note sturdy, compact "Buffalo" circulating pump at right.

"Buffalo"

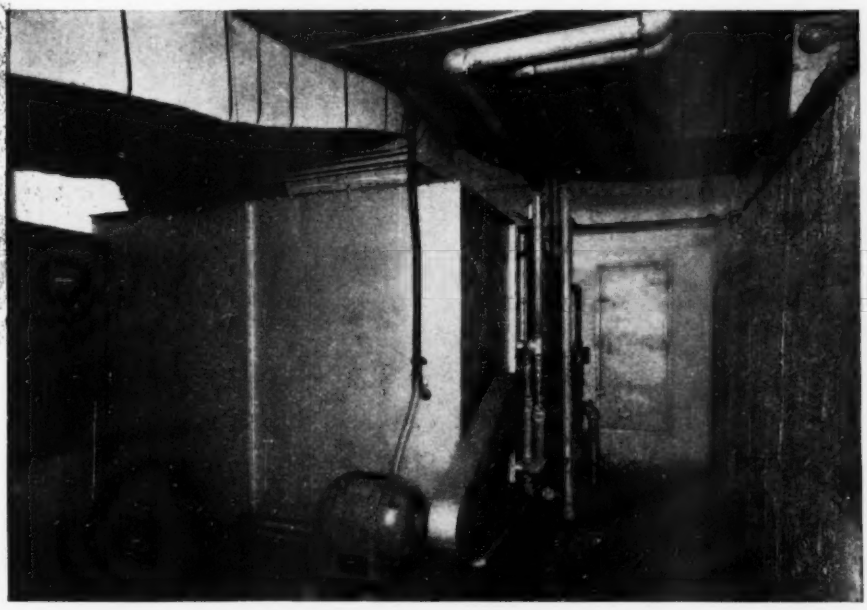
Air OF COMFORT

COMFORT: "State or feeling of contented enjoyment in physical or mental well-being"—*Webster*

The handsome, modern building of the Torreon Branch, Banco de Mexico, where air conditions are always excellent, thanks to "Buffalo" equipment.

This state of comfort, of "physical or mental well-being" is a profitable state for any business or industry to cultivate! And it's easily accomplished. "Buffalo" Units can produce and maintain the right climate indoors, regardless of outdoor weather.

Whether you need dust removal, heating, cooling, humidifying, de-humidifying or various combinations of the above, there's a "Buffalo" unit to do it for you continuously for years and years at surprisingly little cost. Why not have a talk with youf "Buffalo" representative and see how this "Air of Comfort" pays off?



Washed, tempered air is distributed to the Torreon bank's various rooms by this "Buffalo" Air Conditioning Cabinet. Quiet operation, simple installation and trouble-free maintenance are characteristics of "Buffalo" equipment.

BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

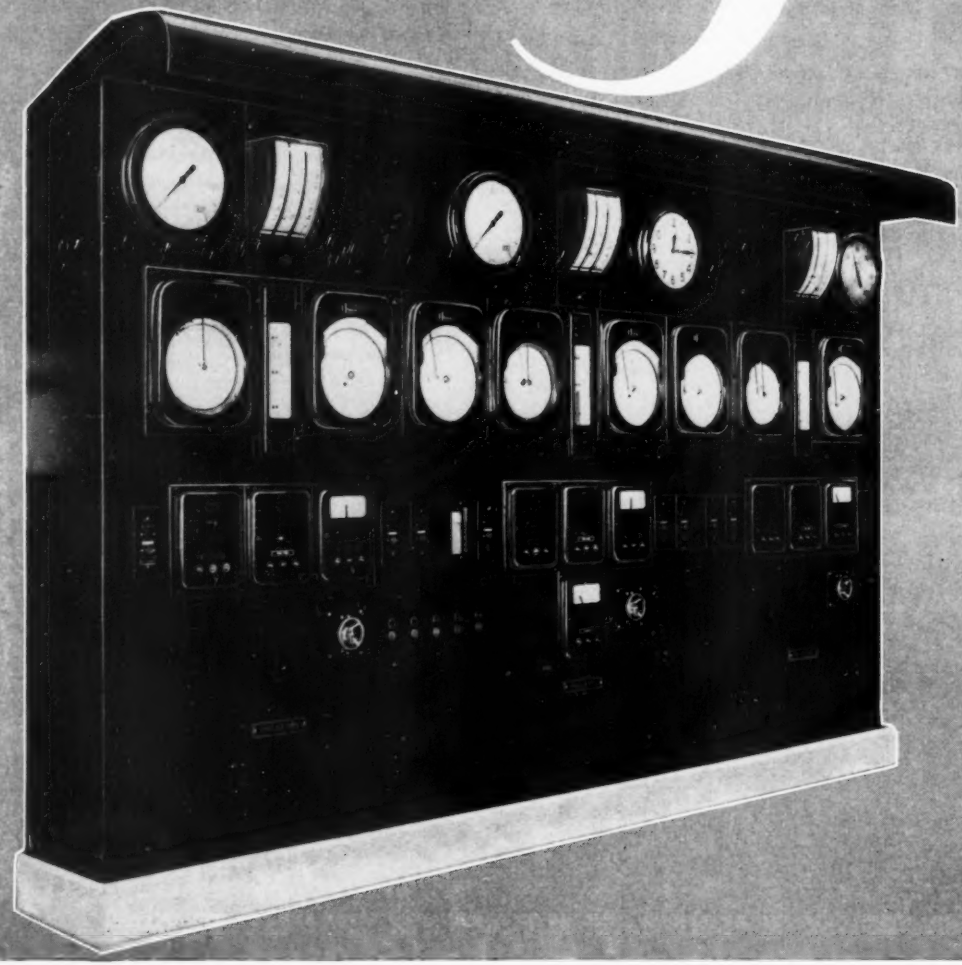
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Prinicipal Cities

* lower **STEAM COST**

* more efficient **COMBUSTION**

* steadier **POWER**



THE MODERN SYSTEM—

through

HAYS CENTRALIZED *Automatic* COMBUSTION CONTROL

It's Electrical!

Hays Centralized Automatic Combustion Control is adapted to steam power plants of all sizes burning all kinds of fuel. Electrically operated, it is years ahead of ordinary systems.

The benefits of Hays Control are positive—*see*-able! Steam is produced at the lowest possible cost; pressure is maintained constant regardless of wide fluctuations in load; combustion is maintained at its highest efficiency. All of which means less smoke, cleaner boiler tubes, better absorption, lower maintenance.

Hays is the *Centralized* system—all control units and measuring instruments are housed in one panel, conveniently located for practical observation. Here is concentrated all the information necessary for intelligent understanding of what is going on inside the furnace, boiler and steam lines. And from this panel *the entire control system or any individual part of it may be operated manually*—through the magic of electricity. Electrical operation makes for simplicity of installation and operation, extreme sensitivity to load changes and instantaneous correctional response.

Hays Centralized Automatic Combustion Control is offered through experienced engineering organizations located in the principal cities of the U.S.A., Canada and abroad. Write for Bulletin 49-605.

HAYS-PENN FLOW METERS

. . . for every type of fluid flow application. Write for special Bulletin 48-805, "How to Buy a Flow Meter." It's Free.

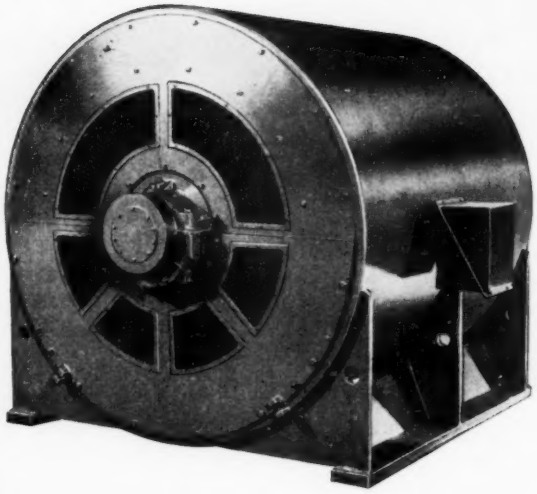
THE HAYS CORPORATION
MICHIGAN CITY • INDIANA

HAYS *Automatic* **COMBUSTION CONTROL**

INDUSTRIAL CONTROL • FLOWMETERS • GAS ANALYZERS • DRAFT GAGES • CO_2 RECORDERS

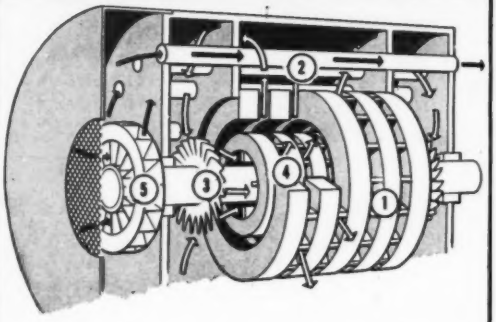
THE HAYS CORPORATION, MICHIGAN CITY, INDIANA

TUBE-TYPE
TOTALLY-ENCLOSED FAN-COOLED MOTORS!



INSTALL INDOORS or OUT!

How Tube Cooling Works



Stator core (1) is surrounded by tubes (2). Internal fans (3) circulate air through ducts (4) in rotor and stator and around tubes, transferring heat to tubes.

External fan (5) drives outside air through tubes, removing heat and keeping tubes clean. All electrical parts are enclosed. Dirt cannot enter.

- **Dirt-proof and corrosion-resistant**
- **Heat exchanger is practically *self-cleaning***
- **Simple self-contained cooling system—sizes from 75 to several thousand horsepower**

WHEREVER DUST, DIRT, fly ash, rain and snow, smoke, or corroding fumes keep motor maintenance costs high, this Allis-Chalmers tube-type motor will cut maintenance sharply.

All electrical parts—including stator core—are enclosed. Simple heat transfer system keeps temperatures well within rated limits. Cleaning is rarely needed because air passages are unrestricted. Air flow through the straight tubes removes foreign matter.

Important savings have been proved in three years of field operation. Sizes from 75 hp and up. Also explosion-proof designs. For complete information, outline your requirements to your A-C Sales Office, or write for Bulletins 05B7150 and 51R7149.

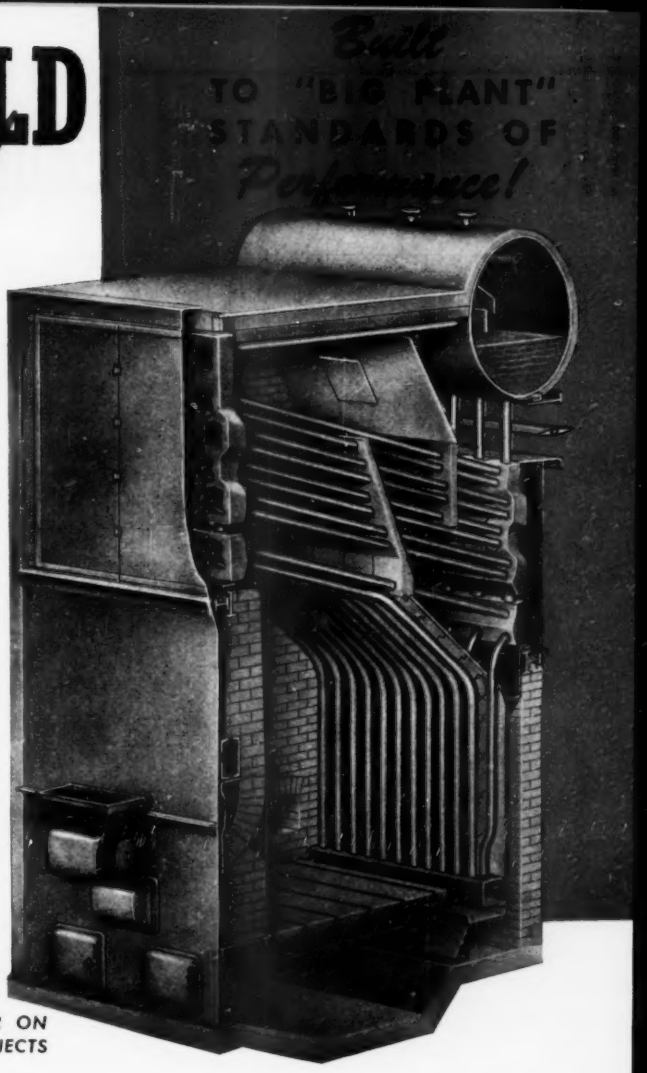
A-2610

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

SPRINGFIELD *Standardized*

TYPE MC COAL FIRED BOILERS



Choice of Sizes —Here is Springfield's new *Standardized* Type MC boiler. Available in a wide choice of sizes to help you meet small to medium size steam plant needs with minimum delay and less capital investment.

Standardized Construction —Boilers are assembled from same component parts. Height and depth are standardized. Width varies according to number of sections used.

Coal, Oil or Gas Firing —Designed for coal firing with standard stokers. Equally adaptable to high efficiency firing with standard oil or gas burners.

Quicker Delivery —Stocks of parts are maintained for prompt assembly and shipping of units. For information on delivery, see your local Springfield representative, or write.

CHECK WITH YOUR CONSULTING ENGINEER ON YOUR MODERNIZATION AND NEW PLANT PROJECTS

SPRINGFIELD PRODUCTS

BENT TUBE STEAM GENERATORS—Modern designs for capacities from 10,000 lbs. up.

STRAIGHT TUBE BOILERS—Specially designed for capacities from 5,000 to 450,000 lbs. per hour and higher.

STANDARDIZED TYPE M BOILERS—Standardized for quicker delivery and lower cost. Sizes 7,500 to 17,000 lbs. per hour.

WATER COOLED FURNACES—Heavy duty water walls. Exclusive center water wall construction for larger units.

SUPERHEATERS — AIR HEATERS — ECONOMIZERS—Individually designed to meet requirements.

BOILER No.	510	610	710	810	712	812	912	1012
Steam Capacity, Lbs. per Hr., continuous	7,500	9,000	10,500	12,000	12,500	14,300	16,000	17,800
Heating Surface, Sq. Ft.	895	1,077	1,256	1,430	1,490	1,703	1,918	2,128
Furnace Volume, Cu. Ft.								
Oil or Gas	305	360	415	475	550	625	700	775
Stoker	270	320	370	424	485	555	620	690
Furnace Width	4'7½"	5'6"	6'4½"	7'3"	6'4½"	7'3"	8'1½"	9'0"
Overall Width	8'2½"	9'1"	9'11½"	10'10"	9'11½"	10'10"	11'8½"	12'7"
Overall Length	11'11¼"	11'11¼"	11'11¼"	11'11¼"	13'10¼"	13'10¼"	13'10¼"	13'10¼"
Overall Height	19'4"	19'4"	19'4"	19'4"	19'4"	19'4"	19'4"	19'4"
Furnace Depth	7'10"	7'10"	7'10"	7'10"	9'7"	9'7"	9'7"	9'7"
Steam Outlet Size	4"	6"	6"	6"	6"	6"	6"	6"
Feed Inlet Size	1½"	1½"	2"	2"	2"	2"	2"	2"
Blow Off Size	2"	2"	2"	2"	2"	2"	2"	2"

SPRINGFIELD BOILER CO.

1953 E. Capitol Avenue — Springfield, Illinois

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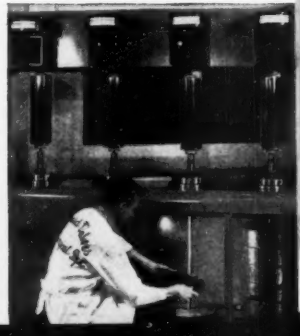
See our catalog in SWEET'S

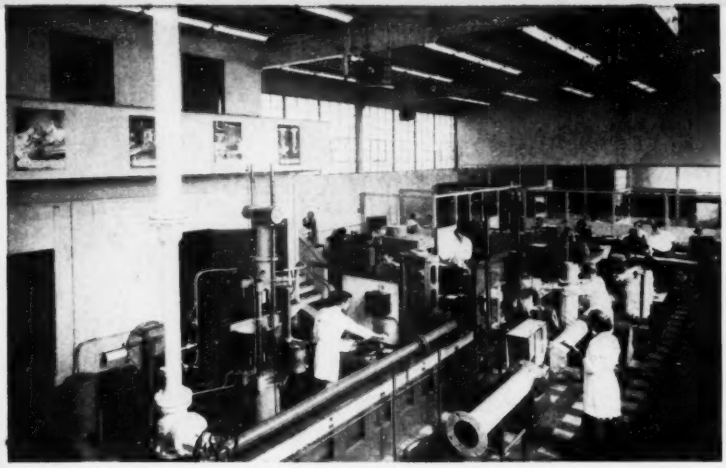
New Edward Laboratory Pledges

Spacious new Edward physical and chemical laboratory at East Chicago, Indiana. Below, typical experimental units. Left, machines in background permit wide variety of hardness tests; in foreground, fatigue testing machines and polishing equipment for microscope specimens. Center, stress analysis room where effects of internal and external loads are measured with brittle lacquer and strain gages. Right, applying dead weight loads to steel test bars in stress rupture machine which records time until rupture of steel at constant load in high temperature furnaces.



'FINEST STEEL VALVES'

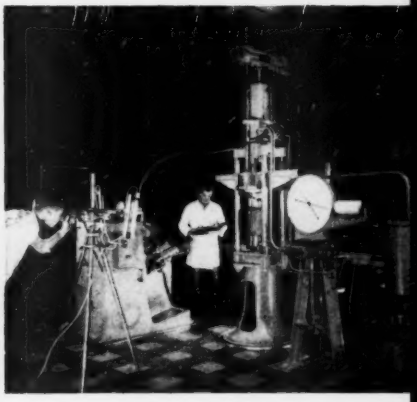
EDWARD VALVES, Inc. OPENS LARGEST LABORATORY FOR STEEL VALVE RESEARCH ONLY



View of portion of physical laboratory. Hook-up in right foreground is for checking flow and pressure drop through experimental and actual valve designs and has guided development of new Edward valves with low pressure loss and minimized turbulence.

Metallographic room, with microscope equipment for examination of metals at high magnification, Dialatometer for the measurement of thermal expansion and phase changes, and Polariscope for stress analysis of plastic models.

Left, section of chemical laboratory with combustion train for carbon analysis of steel samples in background. Right, impact testing machine measuring energy absorbed in breaking small notched bar specimens, with furnaces for high temperature and liquid air for sub-zero experiments.



Hydraulic tensile testing machine set to measure strength of steel specimen at elevated temperatures while pulsator in background applies variable load.

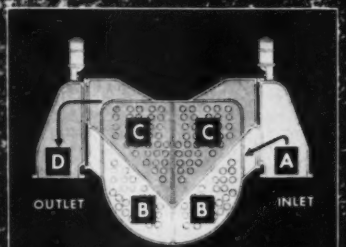
To years of pioneering experience in the field of pressure-temperature piping in the power plant, petroleum and technological fields, Edward has added a large new constant temperature laboratory, dedicated to the single purpose of research into the special problems created by higher and higher design pressures and temperatures. No other laboratory devoted exclusively to steel valve research is so well equipped and staffed. For the tough jobs . . . for steel valves from ½ to 14 inch . . . look to Edward. From Edward you can expect the best,

Another Rockwell Product

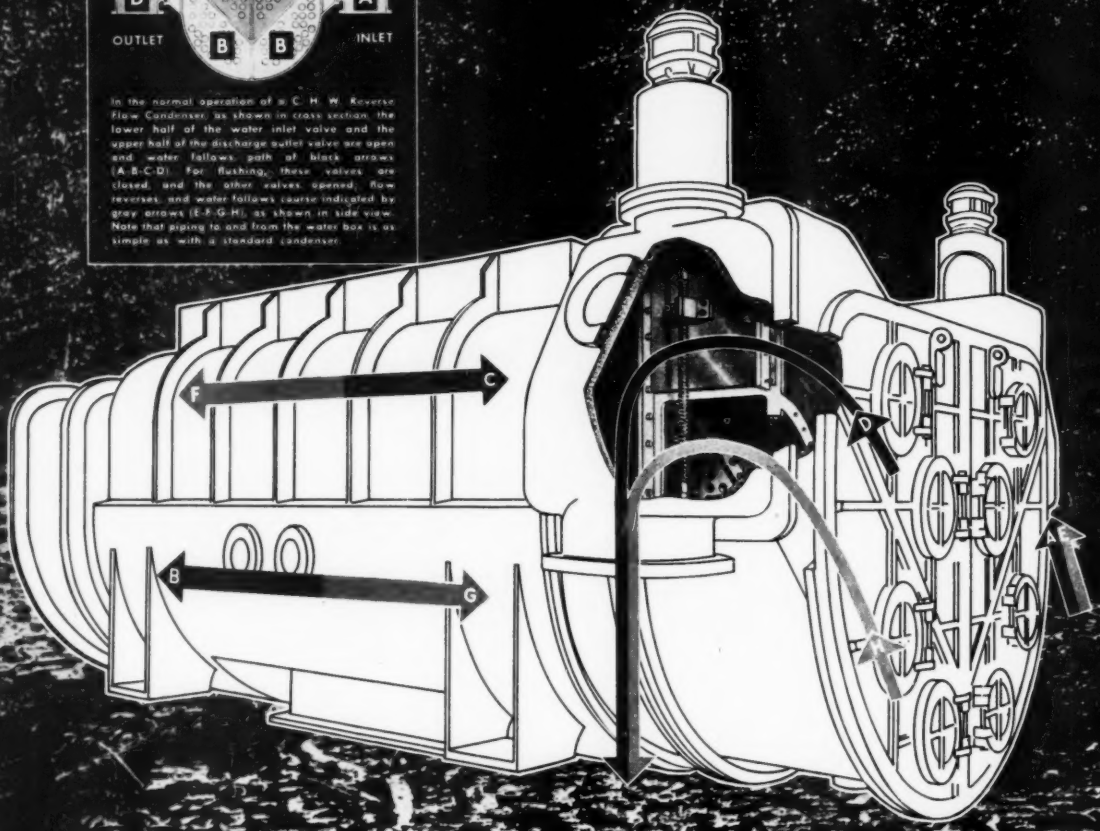
Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

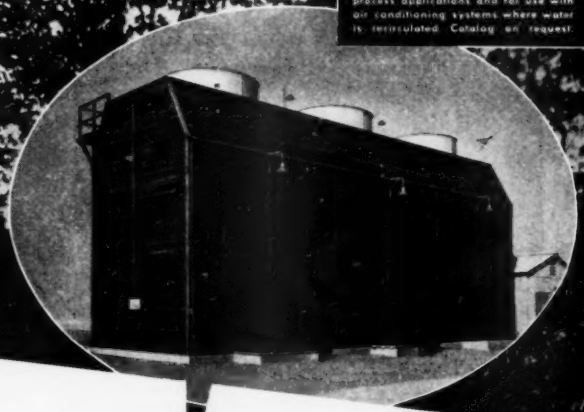
EAST CHICAGO, INDIANA



In the normal operation of a C. H. W. Reverse Flow Condenser, as shown in cross section, the lower half of the water inlet valve and the upper half of the discharge outlet valve are open and water follows path of black arrows (A-B-C-D). For flushing, these valves are closed, and the other valves opened; flow reverses, and water follows course indicated by gray arrows (E-F-G-H), as shown in side view. Note that piping to and from the water box is as simple as with a standard condenser.



C. H. Wheeler



Water Cooling Towers for power and process applications and for use with air conditioning systems where water is recirculated. Catalog on request.

A Beautiful Autumn Scene

BUT IT BRINGS CONDENSER TROUBLES TO PLANTS WITHOUT "REVERSE FLOW"

To an artist or photographer, this woodland stream in autumn is something to rave about. Likewise, to the operator of a power plant downstream, it is something to rave about, but not in ecstasy. Leaves, trash and debris that pass through water screens can cause serious vacuum loss in steam condensers. If he has undivided water box condensers, this scene means to him, frequent shutdowns for cleaning. If he has divided water box condensers, it means the same cleaning, while operating at reduced load or vacuum. But if he has C. H. Wheeler integral reverse flow condensers, he can smile and enjoy the scenic beauty. He knows that he can instantly and automatically clean fouled tubes and tube sheets anytime, by merely pushing a button. This reverses the flow of condenser circulating water and washes away any obstructions. Economies of continuous peak condenser efficiency, without costly cleaning, makes management smile, too, because the money saved pays for C. H. W. "Reverse Flow" in a short time. These economies are available for any size condenser, the smallest now operating being 10,000 sq. ft. and the largest, 50,000 sq. ft. Write for more information and the name of a user having a condenser of a size in which you are interested.

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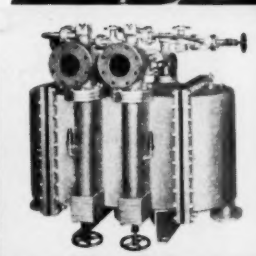
REPRESENTATIVES IN MOST PRINCIPAL CITIES

SINCE 1903

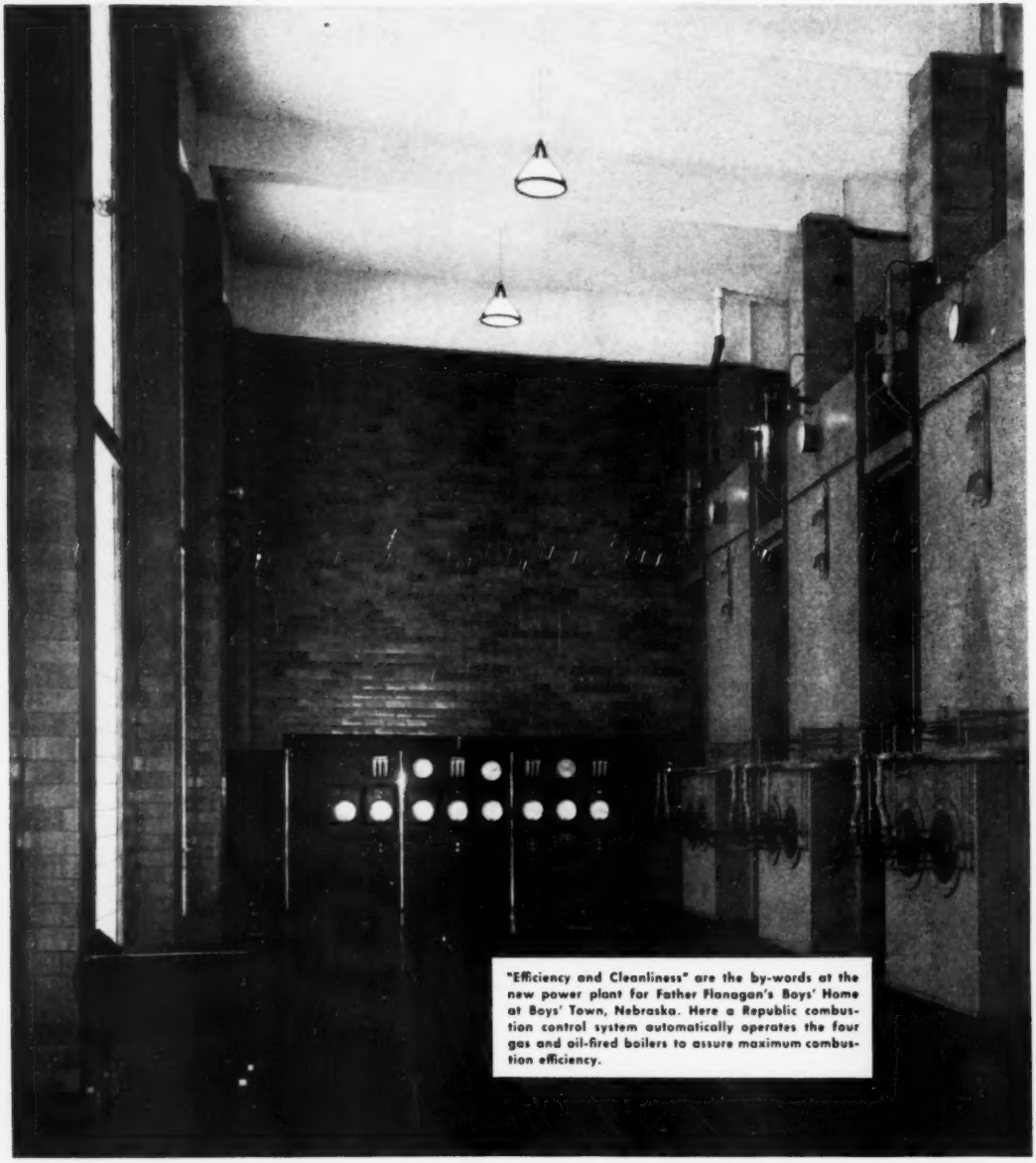


Steam Jet Ejectors for surface condensers; also single and multi-stage ejectors with barometric or surface condensers for process applications. Send for catalog.

STEAM CONDENSERS • WATER COOLING TOWERS
EJECTORS • STEAM JET VACUUM REFRIGERATION

OF PHILADELPHIA

More Steam FROM Less Fuel

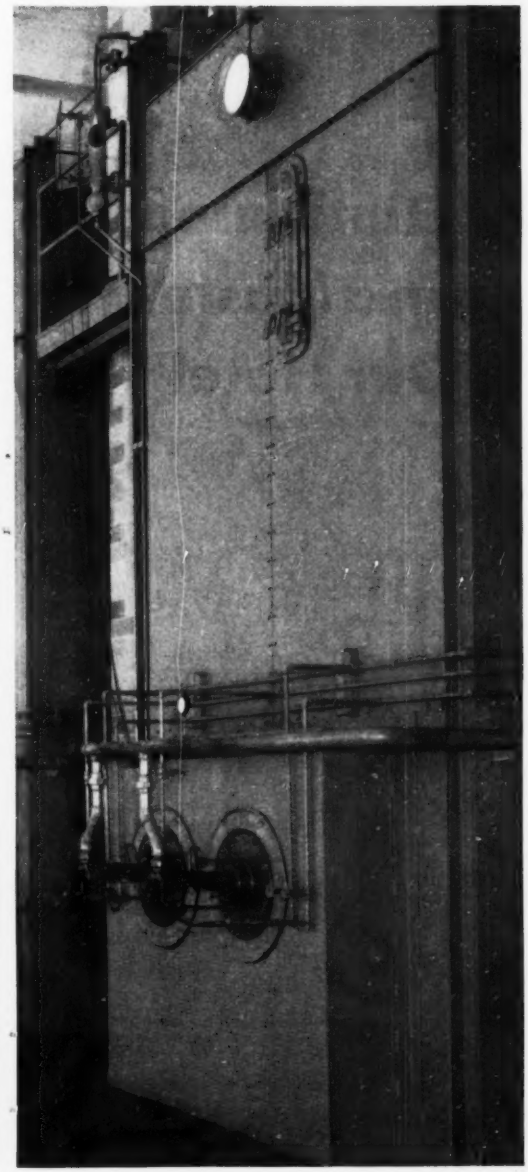


"Efficiency and Cleanliness" are the by-words at the new power plant for Father Flanagan's Boys' Home at Boys' Town, Nebraska. Here a Republic combustion control system automatically operates the four gas and oil-fired boilers to assure maximum combustion efficiency.

REPUBLIC FLOW METERS CO.

WITH **REPUBLIC**

Automatic
COMBUSTION CONTROL



Low steam cost is not the result of efficient boiler design alone! It is determined by the degree with which your method of boiler control takes full advantage of those economies which have been "built in" your boiler and its auxiliaries.

In operating a modern boiler there are a number of repetitive adjustments which must be made frequently and practically simultaneously on several units of auxiliary equipment if highest boiler efficiency is to be maintained. The difficulty of making the required repetitive adjustments, accurately and simultaneously by hand at the individual auxiliaries, is obvious.

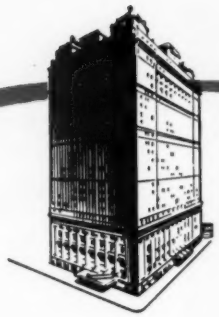
The REPUBLIC combustion control makes and co-ordinates these adjustments automatically, at the same time permits the operator to assume manual control from a centralized control point whenever necessary or desirable.

The REPUBLIC combustion control is a unified system controlling simultaneously, in measured quantities and in fixed (adjustable) proportions, the fuel and air input to the boiler. It increases and decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

REPUBLIC combustion control systems are designed and built for all sizes of boilers — all types of fuel firing equipment — all load conditions. They fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of everyday operating requirements.

Ask for your copy of Data Book S-21.

2240 DIVERSEY PARKWAY
CHICAGO 47, ILLINOIS



Hotel Book-Cadillac
Detroit, Michigan

"We Completely Eliminated Excessive Heating in a Master Control Switch in Our Hotel"

"The 800 ampere renewable fuses, formerly used in the switch controlling a generator, gave us a lot of trouble due to excessive heating. This heating caused them to open 4 or 5 times a year.

"The problem was a serious one.

"On January 22, 1948, we replaced the fuses with 600 ampere Fusetron fuses. That was 15 months ago and to date not one Fusetron fuse has opened. The Fusetron fuses are operating very cool and have completely eliminated the excessive heating in the switch.

"We're certainly pleased about the ability of Fusetron fuses to hold in this installation."

John E. Nesmith, *Chief Electrician*,
HOTEL BOOK-CADILLAC
Detroit, Mich.

When we Switched to.....

Facts About FUSETRON Dual-Element FUSES

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

Fusetron DUAL-ELEMENT Fuses

with their

10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Stop Wasting Time and Money

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name _____

Title _____

Company _____

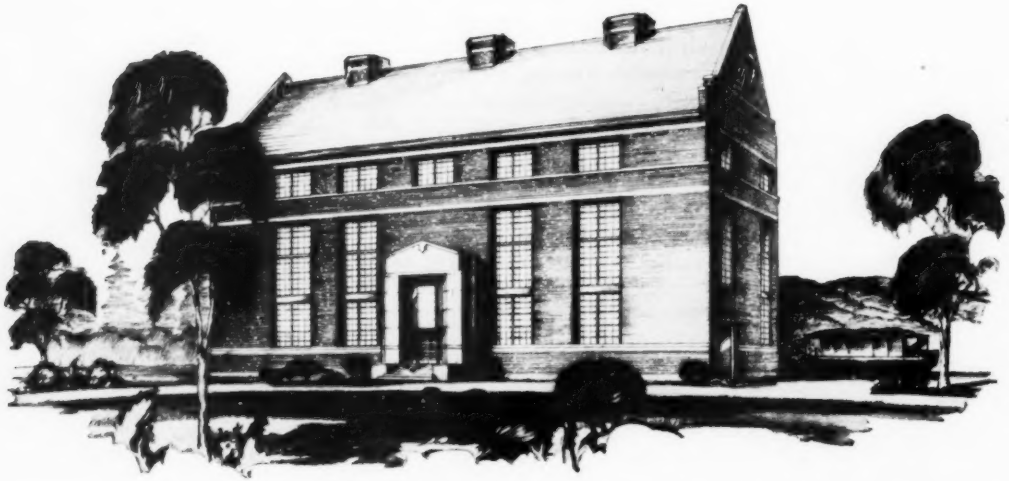
Address _____

City & Zone _____ *State* _____ 949

MODERN DESIGN AND EFFICIENCY GO HAND IN HAND WITH WICKES QUALITY AT *Michigan State College* EAST LANSING, MICHIGAN

This modern steam generation plant pictured below houses the *eleventh* Wickes Boiler installed at Michigan State College with space provided for the 12th unit. Working to the specifications of Claud R. Erickson, consulting engineer of Lansing, Michigan, Wickes designed a 3-drum boiler that makes this installation the *most modern, efficient generation plant* to be found at any educational institution in the country. Boiler specifications: capacity, 125,000 lb. per hr.; design pressure, 350 psi; total steam temperature, 550°F

Wickes has the engineers, the manufacturing facilities, and the skilled workmen to fill your requirements for *boilers of any type up to 250,000 lb. steam per hour and 850 psi.* Your inquiries will receive prompt attention.



WICKES

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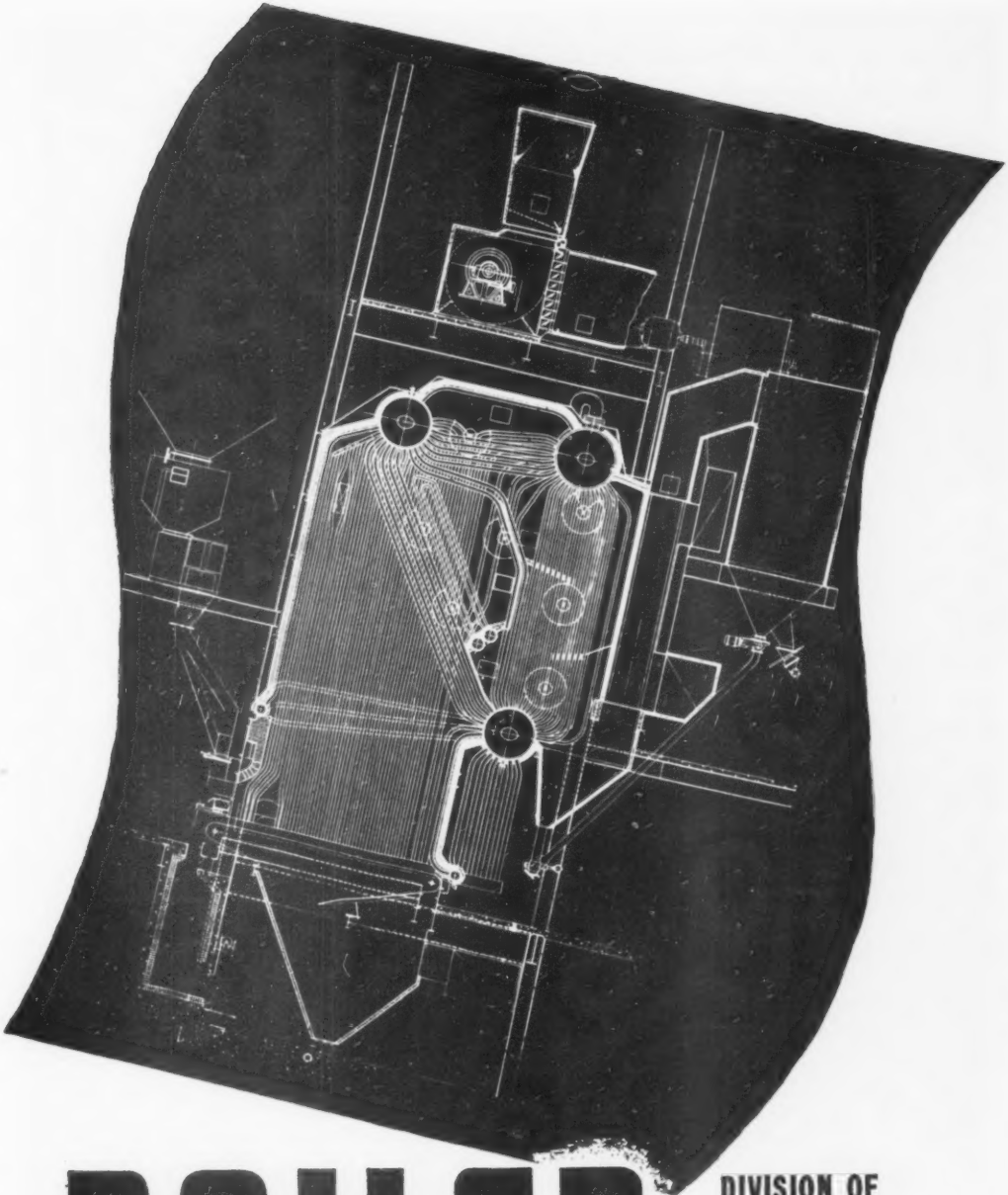

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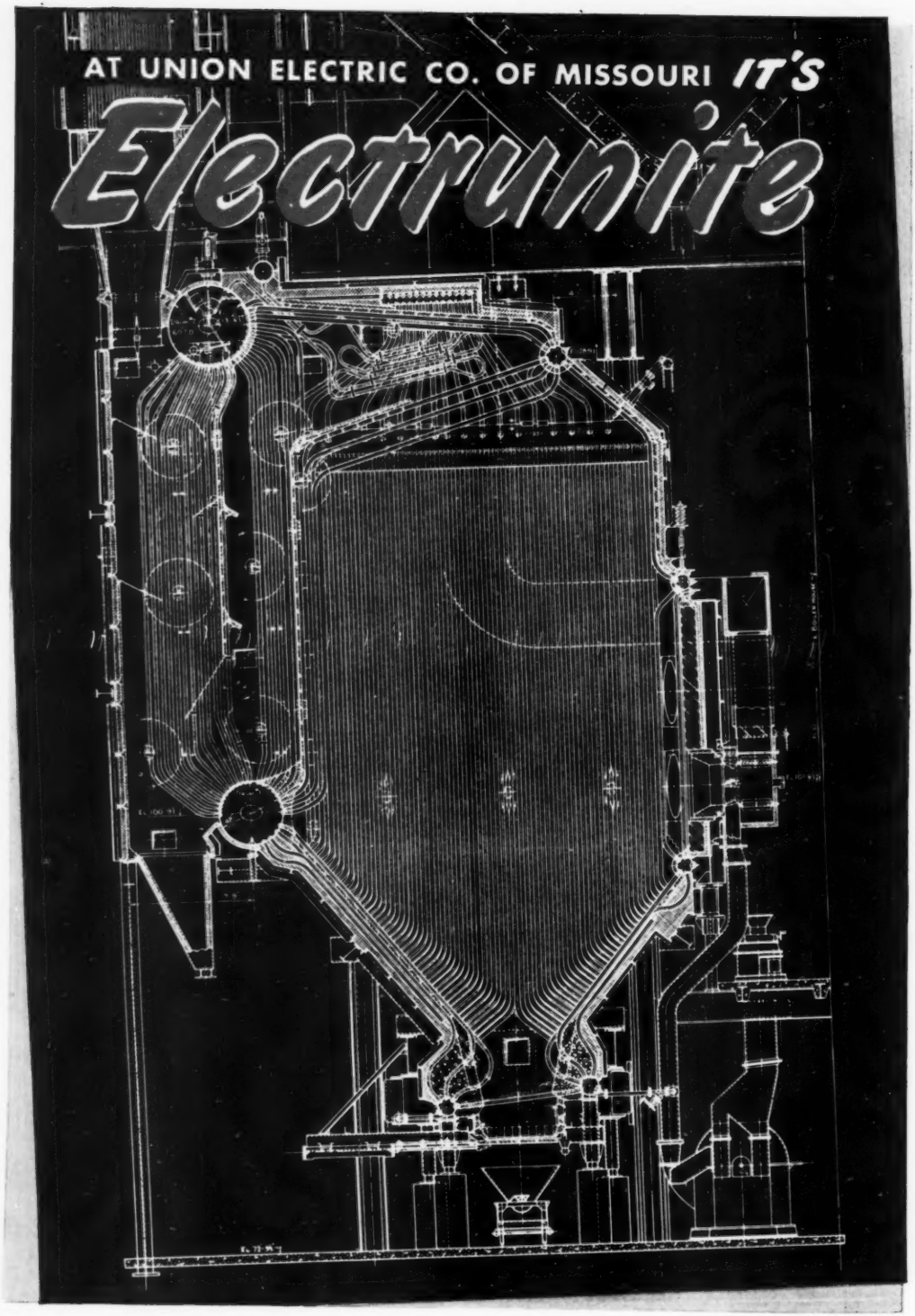

AT UNION ELECTRIC CO. OF MISSOURI IT'S
Electrunite

Boiler Tubes

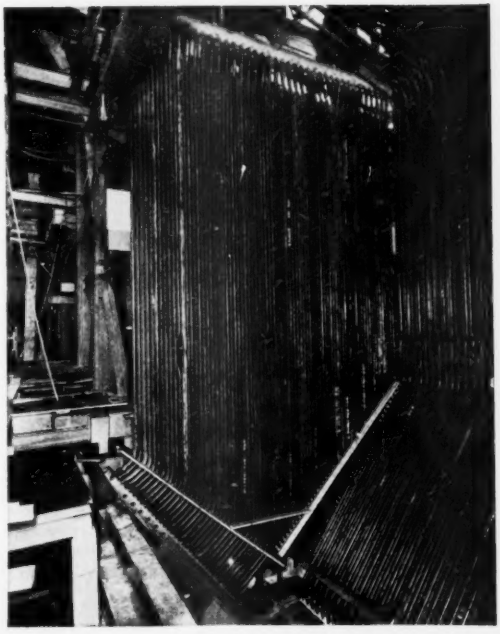
IN THREE NEW RILEY STEAM GENERATING UNITS INSTALLED IN ASHLEY STREET POWER PLANT, ST. LOUIS

Originally erected in 1906, the Ashley Street Power Station of Union Electric Company of Missouri currently is being rehabilitated with up-to-date boiler equipment. Included in this modernization program are three new Riley Steam Generating Units with a combined capacity of 930,000 lbs. of steam per hour . . . each tubed with *modern* Republic ELECTRUNITE Boiler Tubes. Thus *another* old and respected name in the power utility field joins the ever-growing list of ELECTRUNITE installations.

In this, as in countless other installations, there were sound reasons for the manufacturer's choice of ELECTRUNITE Boiler Tubes. *Uniformly high ductility throughout every tube . . . uniform straightness, concentricity, strength and soundness . . . freedom from rolled-in scale and scale pits* . . . all contribute toward fast, easy installation and trouble-free long boiler life.

NOW, before the need for new equipment arises, is the time to investigate *all* of the cost-saving advantages which result from the ELECTRUNITE Process of tube manufacture. For complete information, write, wire or phone *today*.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

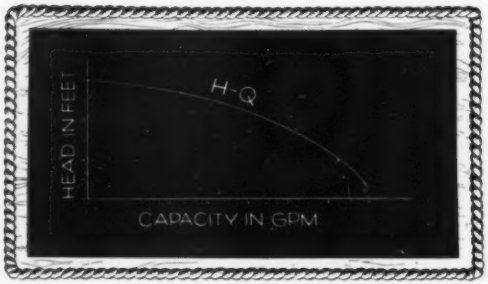


This photo, taken during erection of one of the three Riley Steam Generators, shows the inside left furnace wall.

Republic
REPUBLIC STEEL
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

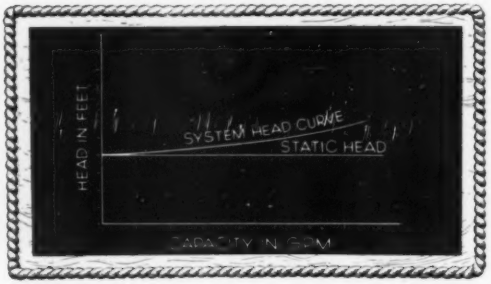
Pointers on Pumps

HOW MUCH WILL A CENTRIFUGAL PUMP DELIVER?



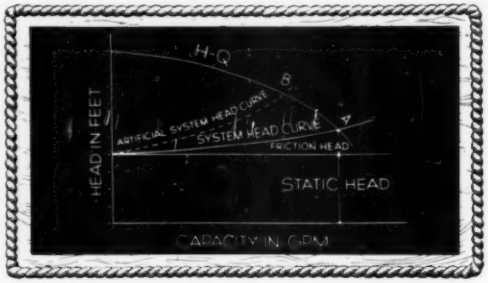
1 The capacity of a constant speed centrifugal pump whose head capacity characteristics (H-Q) are shown in Figure I on any piping system can be determined as follows:

2 Plot the friction loss through all piping, valves and fittings at different rates of flow. Use any standard friction tables, making allowances for age and condition of pipes.



3 Static Head is the difference between liquid levels in suction and discharge vessels plus the algebraic difference of pressure, between suction and discharge vessels, expressed in feet. Combining the friction head curve at different rates of flow with the static head gives the system head curve, which is total head in feet*.

*See method of calculating head described in previous advertisement in this series. We will gladly send you a copy.



4 When the head capacity curve (Figure I) is superimposed on the system head curve, (Figure III) the intersecting point "A" is the capacity that will be delivered by the pump on this system. If a smaller capacity is desired, partial closing of the discharge valve will produce an "artificial" system head curve, giving capacity at point "B". Any capacity between point "A" and shut-off (zero capacity) may be obtained by adjusting discharge valve.

ANY OTHER PROBLEMS?

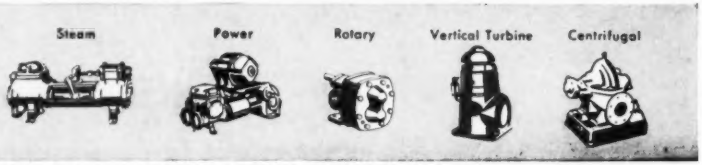
Worthington's engineering department — backed by the longest and broadest experience in the field — will do its best to solve them. Because in addition to making the most complete line of pumps, Worthington makes its technical service fulfill the promise that *there's more worth in Worthington . . .*

Contact our nearest District Office, or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

WORTHINGTON

C9-1

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



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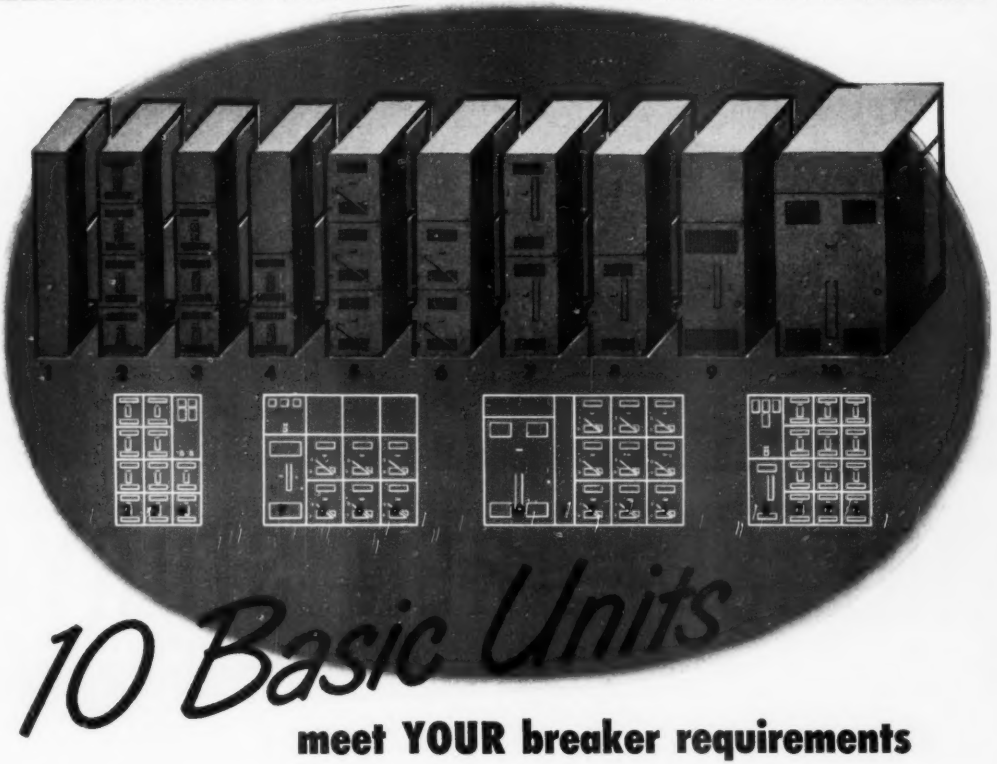

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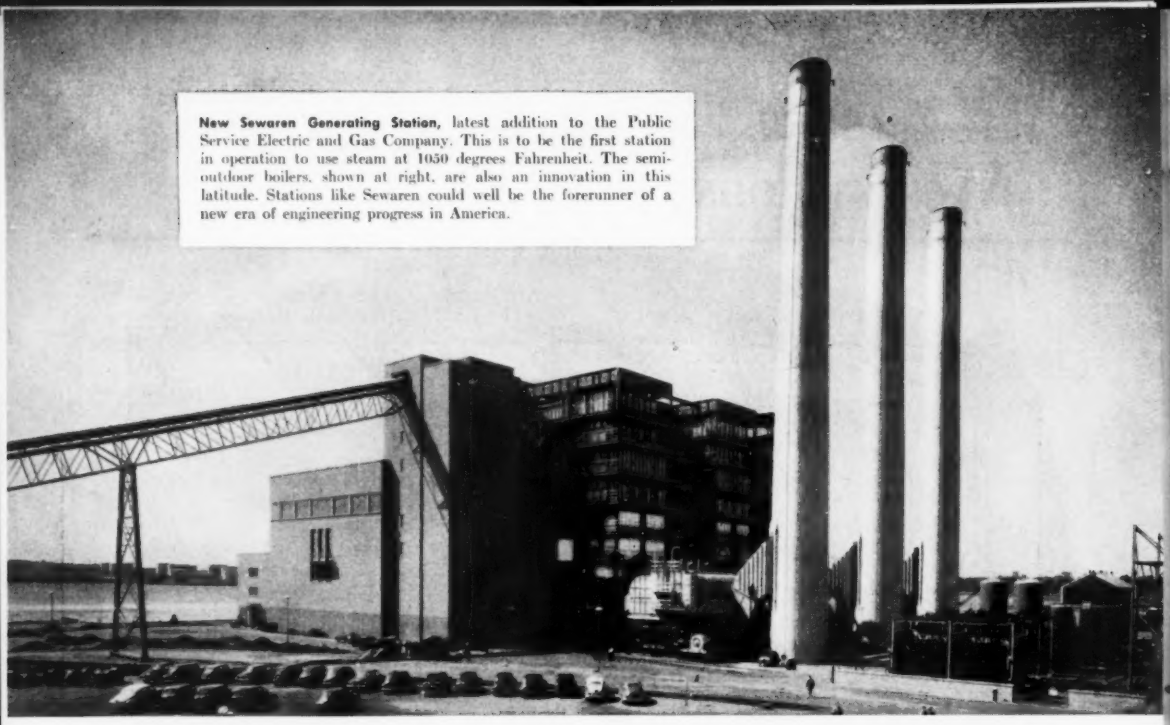
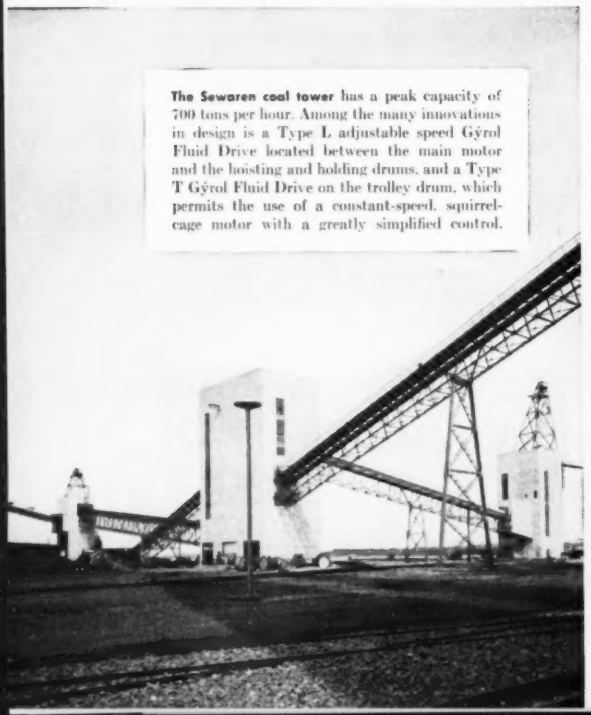
LOW-VOLTAGE
SWITCHGEAR

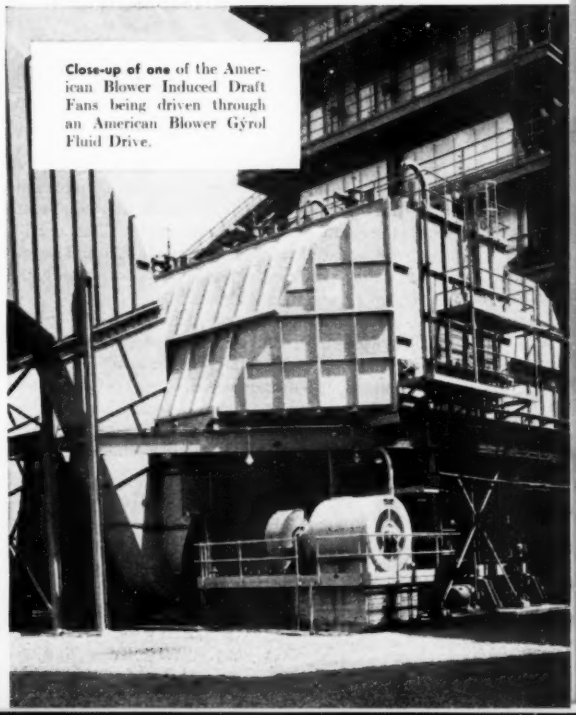


New Sewaren Generating Station, latest addition to the Public Service Electric and Gas Company. This is to be the first station in operation to use steam at 1050 degrees Fahrenheit. The semi-outdoor boilers, shown at right, are also an innovation in this latitude. Stations like Sewaren could well be the forerunner of a new era of engineering progress in America.

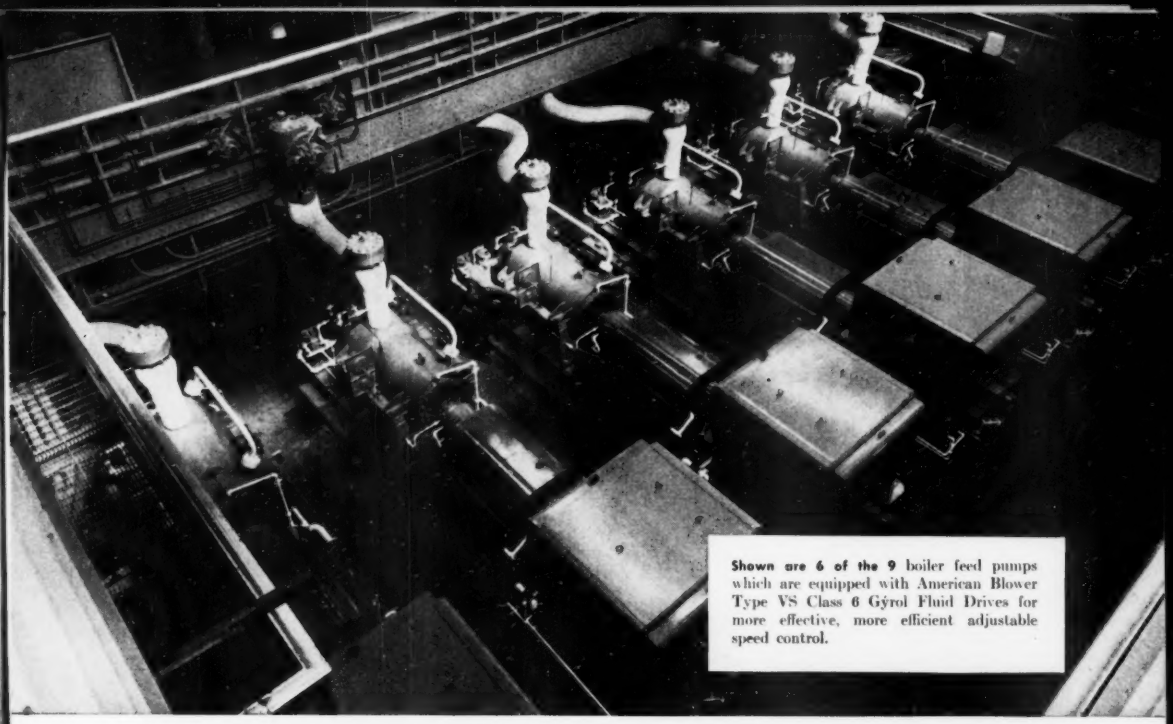
THE SEWAREN STORY!



The Sewaren coal tower has a peak capacity of 700 tons per hour. Among the many innovations in design is a Type L adjustable speed Gyrol Fluid Drive located between the main motor and the hoisting and holding drums, and a Type T Gyrol Fluid Drive on the trolley drum, which permits the use of a constant-speed, squirrel-cage motor with a greatly simplified control.



Close-up of one of the American Blower Induced Draft Fans being driven through an American Blower Gyrol Fluid Drive.



Shown are 6 of the 9 boiler feed pumps which are equipped with American Blower Type VS Class 6 Gýrol Fluid Drives for more effective, more efficient adjustable speed control.

New modern generating station marks another milestone of progress in the American way of life—brings compliments from many quarters to Public Service Electric and Gas Company for farsightedness and progressive spirit.

America in general, and New Jersey in particular, can look forward to great progress as forecast by the formal opening of the new Sewaren Generating Station at Sewaren, New Jersey.

Full of advanced engineering ideas and techniques, embodying the most modern facilities known to man, designed with the future in mind, this new project, for years to come, insures the area it serves an abundant supply of electricity—the lifeblood of American progress.

Long-range planning, like that exemplified in the Sewaren Station, has always paid off in America. It always will.

That we of American Blower were privileged to play a part in making the Sewaren Generating Station a reality, marks a milestone in our own progress upon which we shall always look with pardonable pride.

American Blower furnished for this new modern plant 6 Sirocco Induced Draft Fans, each handling a total of 227,000 cubic feet of gas per minute, at 18.6 inches static pressure, 2 of which are equipped with 1250 h.p. at 570 rpm, adjustable speed Gýrol Fluid Drives; 6 American HS Forced Draft Fans, each having a capacity of 123,000 cubic feet of air per minute, at 22 inches static pressure, and each fan driven through a 600 h.p. at 1135 rpm, adjustable speed Gýrol Fluid Drive; 9 Gýrol Fluid Drives, each having a capacity of 2000 h.p. at 3465 rpm, for adjustable speed control of boiler feed pumps.

What about your plans? If you intend to modernize or enlarge your facilities, we invite you to contact the nearest American Blower Branch Office. You'll find it staffed with experienced engineers who know the meaning of cooperation and service.

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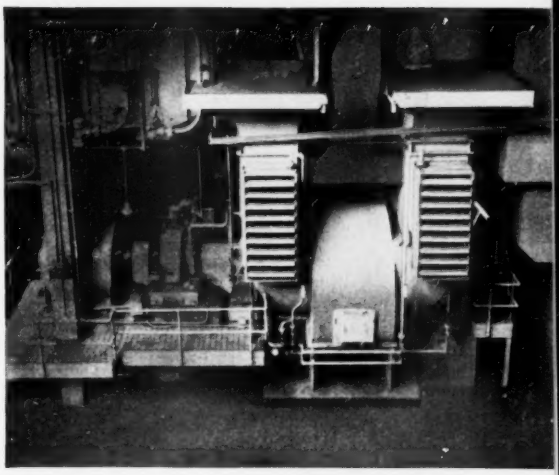
Division of American Radiator & Standard Sanitary corporation



This close-up shows one of six American Blower Forced Draft Fans being driven through an American Blower adjustable speed Gýrol Fluid Drive.

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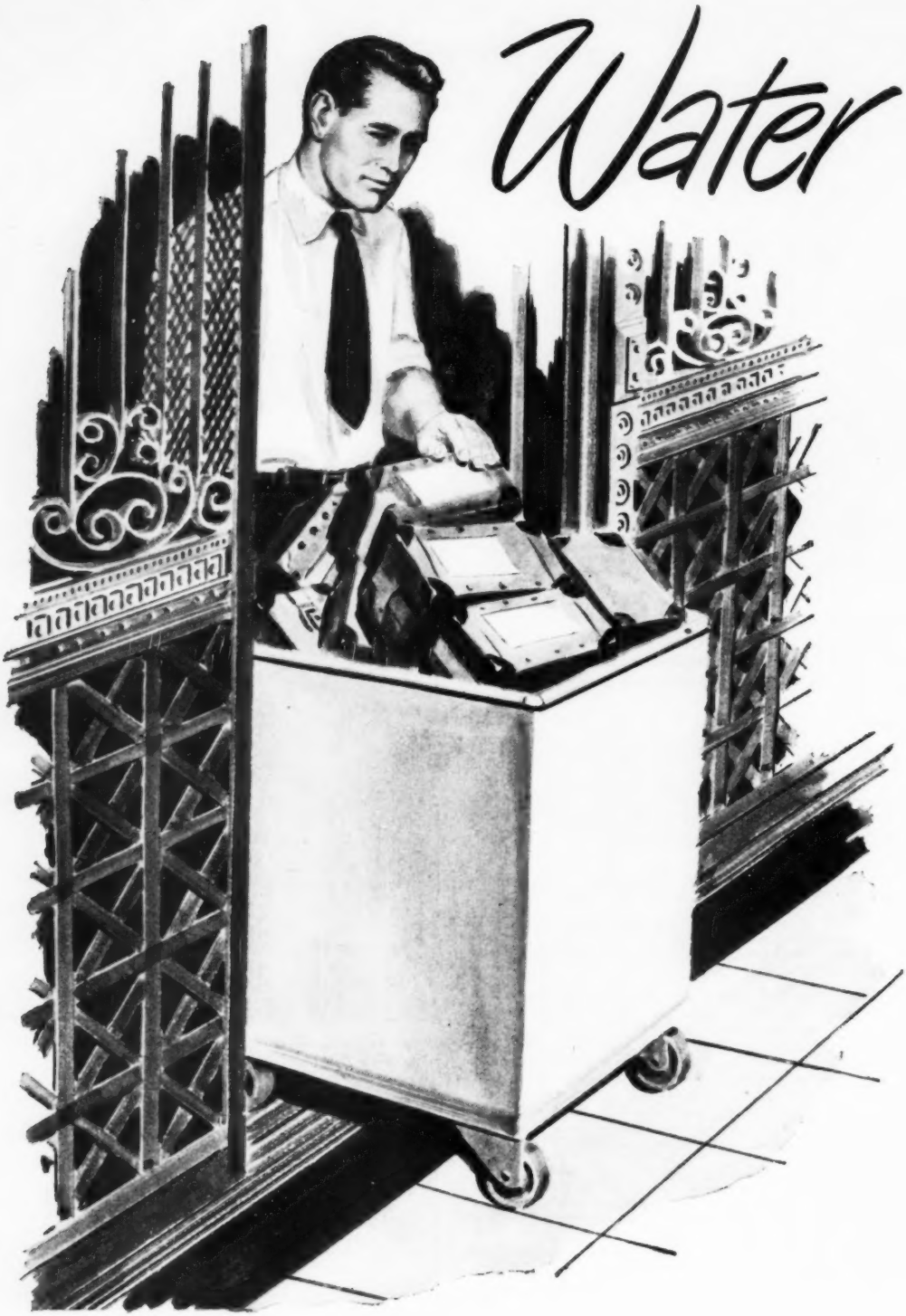
Water



Problems

on their way to solution

Water comes to Hall Laboratories from every corner of the country—raw water from wells and streams, water used in industrial processes, boiler water, waste water.

These water samples represent literally thousands of problems, for every water, every plant, every process, is a distinct problem which may require a thorough study of dozens of related factors before a complete solution is possible. And, of course, a solution is not "complete" unless it represents the most efficient and economic procedure *in that specific situation.*

Hall Service is able to provide complete solutions, because Hall is equipped to consider all of the water problems of an industrial plant *as a whole.* Water sources, water uses, waste recovery and disposal all come within the scope of Hall Service.

Hall analysis of your water problems goes far beyond the water itself. It involves a thorough study of all plant operations involving water. Detailed knowledge of the interrelation of water, plant processes, and equipment has, in many instances, enabled Hall engineers to accomplish, by simple and effective procedures *at the right point*, results which might otherwise require expensive equipment.

This was the case, for example, in a power plant where there was corrosion of turbine blades. Carry-over of chloride in the steam was blamed and installation of an evaporator to supply distilled water for the whole system was recommended. The Hall engineer, however, traced the trouble down and found that, during stand-by, salt water from the barometric condenser hot well was being siphoned back to the turbine. Simple provisions to break the siphon ended the trouble.

In another plant, where purifying waste water before discharging it into a stream was the problem, installation of expensive oil-separation apparatus was planned. Here the Hall engineer showed how the oil contamination could be checked *at its source* with an equipment expenditure of less than $100.

Hall Laboratories offers *plant-wide water service* and invites correspondence concerning this service or any phase of industrial water conditioning. Address Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

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HALL SYSTEM OF BOILER WATER CONDITIONING
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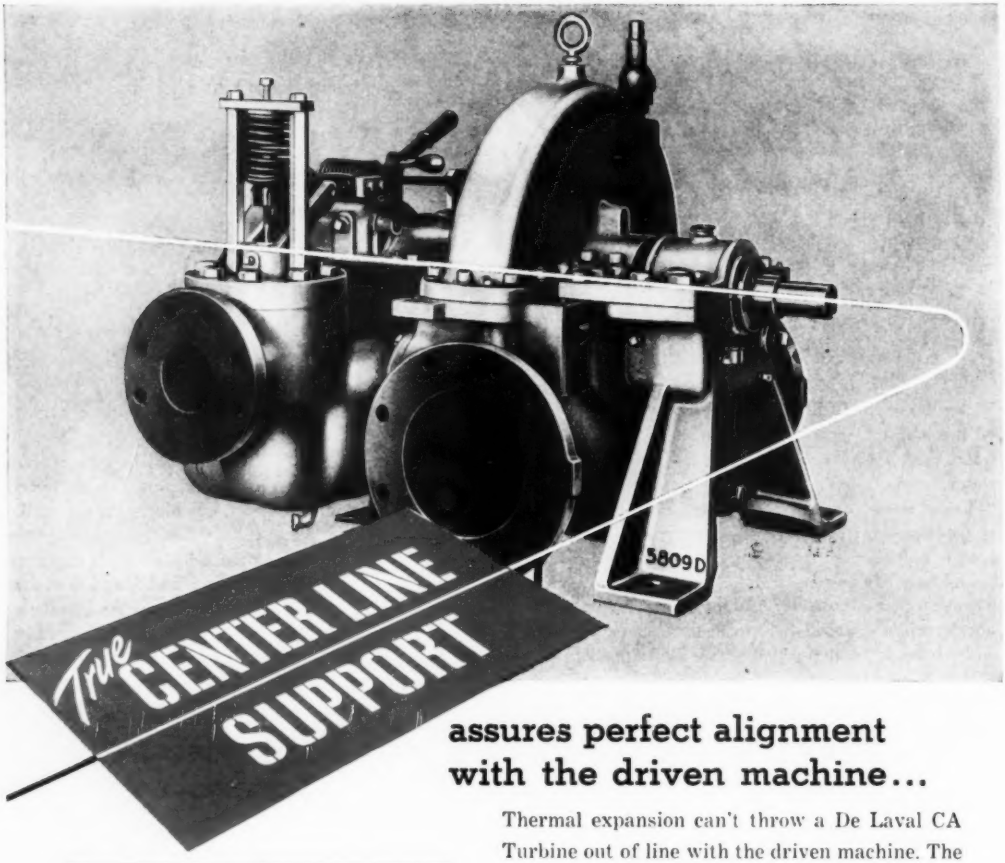
May we send you a copy of this Bulletin?

Reprints of eleven advertisements explaining the inter-relation of all water problems from selection of source to disposal of waste. If you would like a copy, just drop a post-card to Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.



assures perfect alignment with the driven machine...

Thermal expansion can't throw a De Laval CA Turbine out of line with the driven machine. The body of the turbine is supported at the *exact* center line to allow for radial expansion. The front end is mounted on a flexible channel to allow for axial expansion. Thus, both radial and axial expansion can take place under extreme temperatures without disturbing the shaft center line.

This is but one of the many features that assure trouble-free operation with the new De Laval Class CA Turbine under all operating conditions with initial steam conditions up to 600 psi, 750 F.

Before you buy a turbine, be sure and get complete information on these additional De Laval features:

1. A choice of eight governors.
2. Balanced double-seated bonnet-type governor valves for close control of steam flow.
3. *Positive* over-speed protection entirely separate from normal speed governor for unfailing emergency shut-off.
4. Sensitive, friction-free, wear-resistant "rocking chair" governor pivots.
5. Super-smooth, chrome plated shaft journals to make carbon rings last longer.
6. The casing and bearings split horizontally at center line for easy removal and inspection of the rotor, carbon rings and bearings.

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T-23

POWER

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TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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Cover shows Frank R Phillips Power Station of Duquesne Light Co, Pittsburgh, with Unit No. 1 in operation, No. 2 under construction, foundation being placed for No. 3. New units are 51,000 kw each. Photo, courtesy Dravo Corp, construction engineers for this installation.

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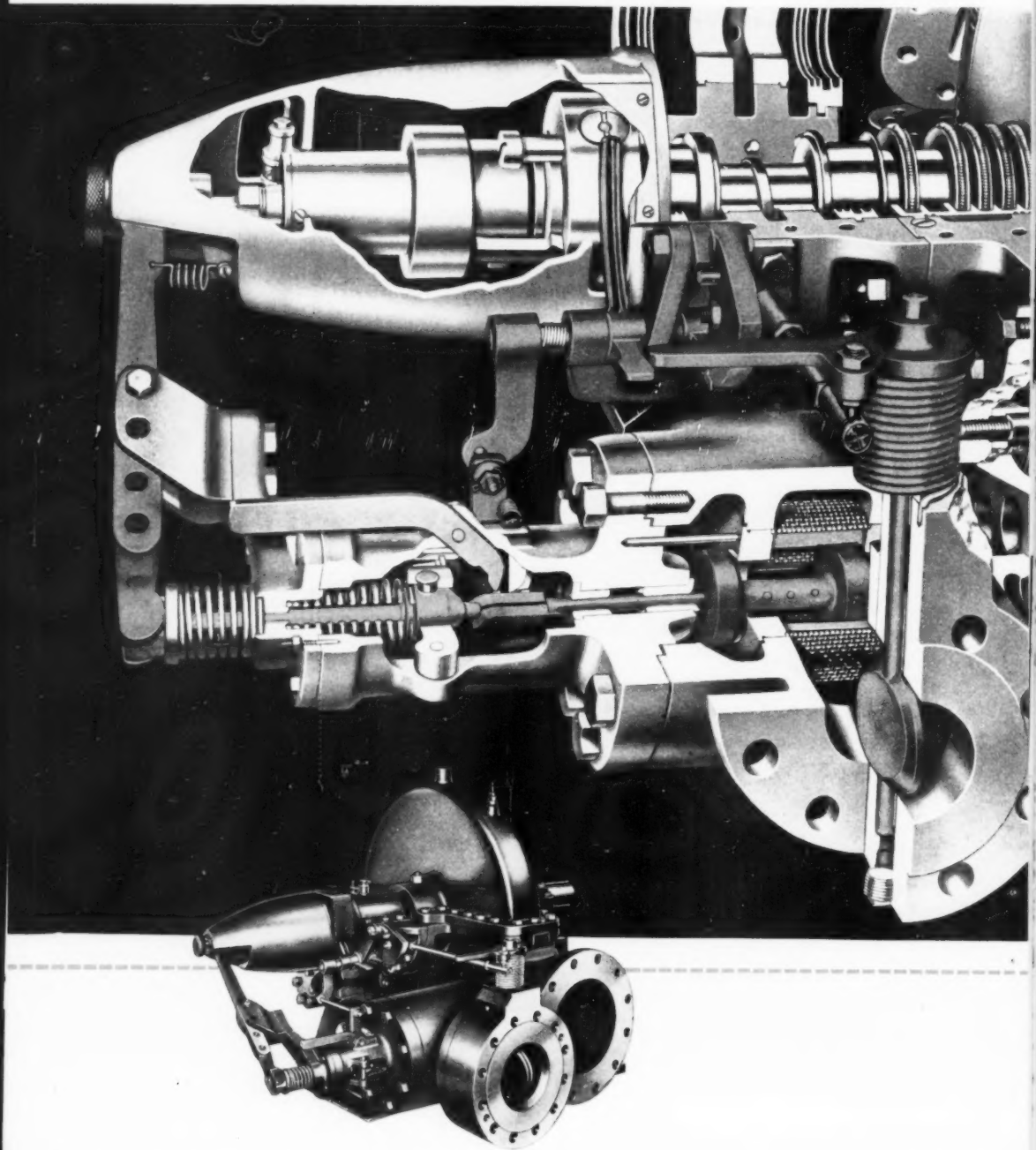

Compare it on ANY count

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With Type E turbines, you can be sure of protection against overspeed. You can be doubly sure.

A sensitive, powerful centrifugal-weight governor provides extremely accurate speed control. Both the governor and its linkage connection are enclosed in a strong, specially-shaped housing to protect them from damage.

However, if for any reason the governor loses control, Type E *dual* protection takes over. A corrosion-resistant, spring-restrained weight, mounted in the governor hub, strikes a trip linkage . . . instantly closes the governor valve and an independent steam inlet butterfly valve. Steam is cut off positively . . . danger and resulting damage of overspeed are avoided.

Dual protection is but one of the significant features of Type E turbines. Wrapped up in one standard unit are the best features of previous Westinghouse mechanical drives, plus important refinements and new developments that add up to economical, dependable service under all operating conditions.

We invite your comparison . . . on *any* count. Get the facts from your nearby Westinghouse office, or write for 20-page book B-3896. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50393

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TYPE E
Turbines

for "AGE RESISTANCE" these B. F. Goodrich Co. stacks are BYERS WROUGHT IRON

The important quality of "Age Resistance" which B. F. Goodrich Company puts into its tires is also a prime requirement in all plant equipment. When two new stacks, each 5-feet x 95-feet, were required at the Akron, Ohio, plant, the engineers specified wrought iron. The stacks were fabricated of Byers Wrought Iron ¼-inch plate by Ohio Machine and Boiler Company.

Unlined metal stacks face severe corrosive conditions, and unless proper safeguards are used, can easily become a maintenance headache. Carbon dioxide is always present as a combustion product, and some sulfur compounds are generally encountered. When these are dissolved in condensed moisture, a dilute acid is formed which causes severe damage to vulnerable materials. Even when initial conditions are not severe, foresight suggests the use of durable material. For the aggressiveness of attack may be aggravated at any time, by a change in fuels—by the use of economizers or steam-jet draft inducers—or by intermittent operation.

Byers Wrought Iron is a veteran in stack service and engineering records provide convincing evidence of its superior durability. Service ratios of two and three to one, as compared to ordinary stack materials, are not at all uncommon.

Wrought iron's resistance to flue gas corrosion is due to its unique character. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and so discourage pitting and penetration. The fibers also anchor the initial protective scale, which shields the underlying metal.

Our bulletin, WROUGHT IRON FOR FLUE GAS CONDUCTORS AND COAL HANDLING EQUIPMENT is filled with interesting and helpful information on stacks. May we send you a copy?

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
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POWER

PHILIP W SWAIN, EDITOR • SEPTEMBER 1949 • ESTABLISHED IN 1882

Operating by Television

TELEVISION IN THE POWER PLANT sounds like a lazy operator's day dream, but it just happens to be practical. That's why American Gas and Electric, after testing out three sets under plant conditions, has ordered ten more for installation on five 935,000-lb-per-hr boilers now being built.

One unit on each boiler will "watch" the water level. The other will make sure that all oil lighter flames are burning before pulverized coal is fed to the furnace.

As the article on page 120 explains in greater detail, each of these sets consists of a television camera connected by coaxial cable to a receiver or "monitor" in the control room. Without moving from the control center, the operator watches the water level on his television screen. There is no possible way in which a fault in the set or its connections can show the level incorrectly.

With the aid of mirrors, the camera of the other television set groups the six lighter flames in a single picture. Six solid-white circles on the monitor screen are proof that all flames are burning.

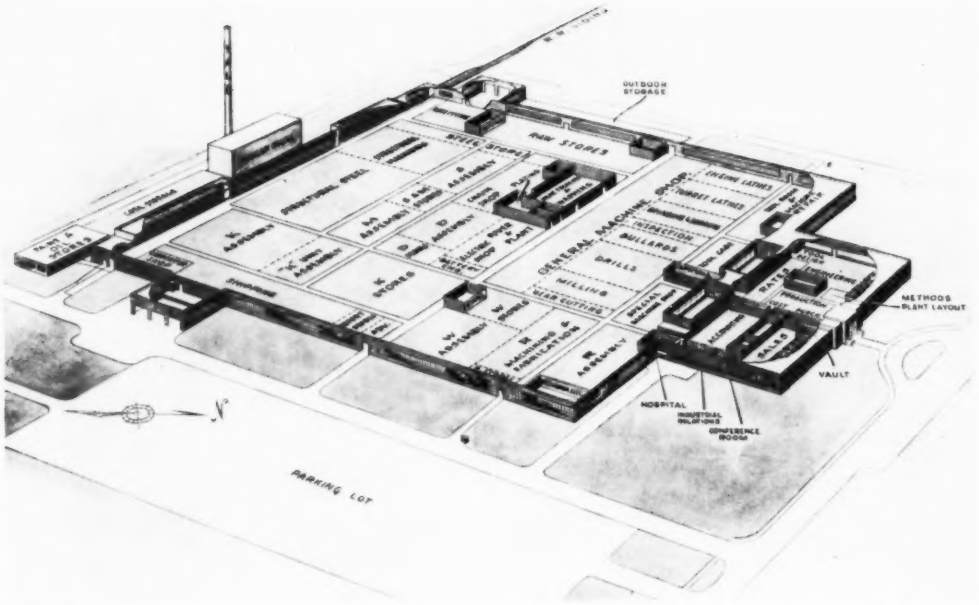
Including camera and cable, each of these units costs about ten times as much as a comparable home receiving television set, yet it pays its keep handsomely. For example, the television setup makes it possible for the chief boiler operator, through remote controls, to manipulate oil lighters and coal burners with complete safety without leaving his control room. It is no longer necessary to have a man on the burner deck during startup, shutdown and other periods of burner manipulation.

This interesting development reminds us that power-plant instrumentation has traveled a long road since the days when a steam gage and a water glass made a finished job. Over the years the measuring devices have multiplied amazingly.

Today thermometers and pyrometers of many types measure temperatures of steam, flue gas and water. Pressures are measured all the way from boiler steam down to furnace air and turbine exhaust. Flow of water, steam, air and other fluids is metered. Other instruments analyze the stack gases and compare steam flow with furnace-air flow. They measure pH values, water conductivity and dissolved oxygen content.

And long ago instruments began to do their own bookkeeping, read their own dials, record and totalize the readings. Then, through controls, the instruments even began to operate the plant—turn valves and make other adjustments according to the instrument readings.

Now, finally, power-plant television allows the operators to see around far corners. Here again is proof that there's always a way to improve old-style operating methods with new-style instruments.



1 New plant has manufacturing area totaling 775,000 sq ft with minimum height under beams of 18 ft. Heating an area of this size uniformly is a major problem. Yale & Towne split the job—air-conditioning in offices, unit heaters in plant

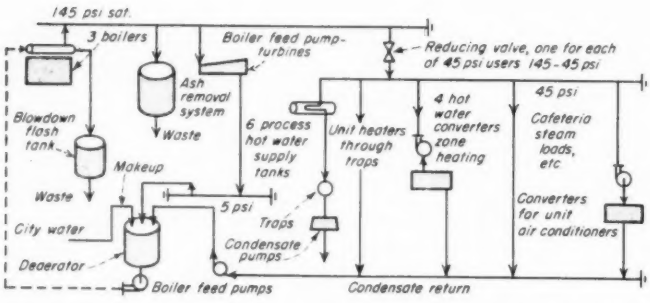
Take Steps to Better Worker Comfort

Ample power services for all needed production tools plus a well-balanced heating and air-conditioning system make for excellent working conditions. Yale & Towne Mfg Co has just built its new Philadelphia plant around this basic principle

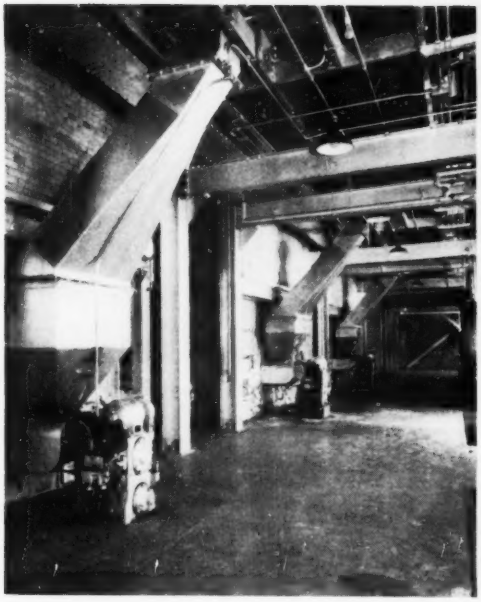
► Yale & Towne Mfg Co has one division, its Philadelphia Works, that specializes in materials-handling equipment. When the company designed its new plant, Fig. 1, in North Philadelphia it was to be expected that it would be built around the latest methods of moving material in a production plant. These methods depend for much of their success on top employe performance. And to get this performance the management saw to it that the plant had ample power services for production and worker comfort. But the engineering to meet these demands faced several problems.

Main manufacturing plant has a total floor area of 775,000 sq ft and minimum height under the beams runs 18 ft. Heating an area of this size is a considerable task. When you add to the normal space-heating problem the heat loss caused by exhaust from the various paint chambers, plant heating becomes even tougher.

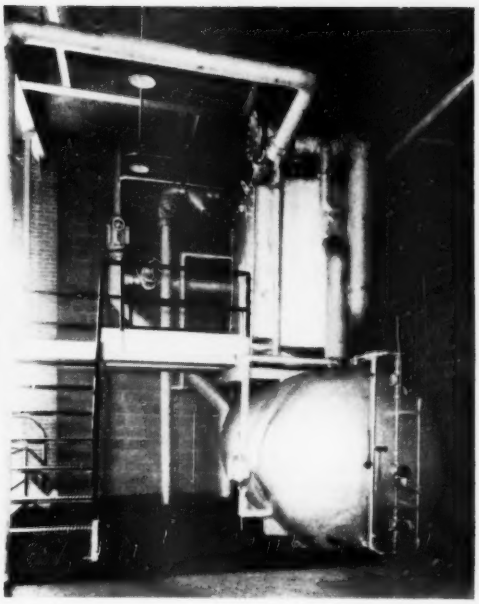
Yale & Towne split its space-heating problem in two: (1) heating of the plant production space (2) air conditioning of the office areas. This latter phase is not yet completed.



4 Flow diagram, above, shows all principal steam-using equipment in the plant, the main headers supplying them, and the pressure levels from which they work



2 Power plant supplies all services but air conditioning. Steam comes from three underfeed stoker-fired units, above



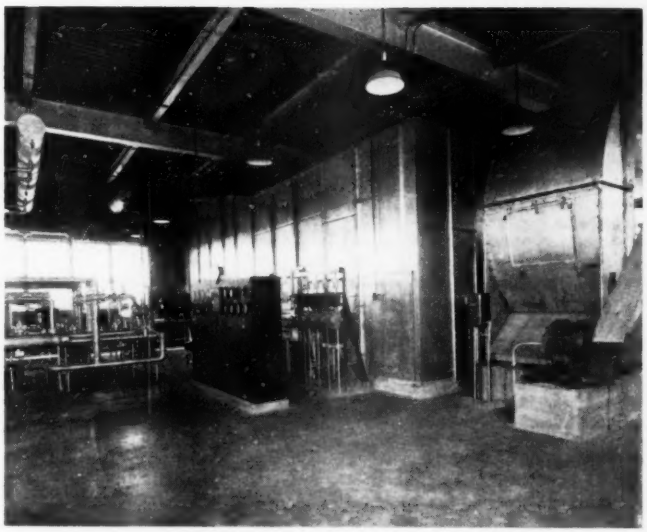
3 Deaerating feedwater heater serves as condensation return point for trapped and pumped returns from heating system

It Pays in More Plant Production

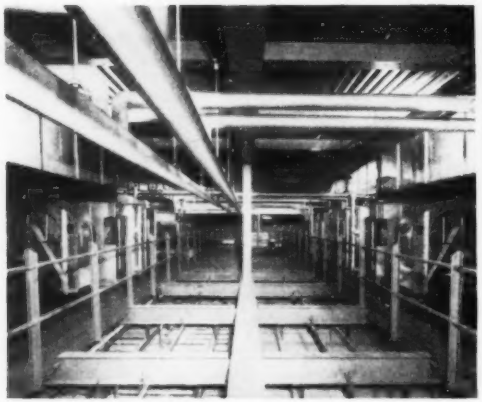
Power Plant. Back of both systems lies the heavy power services' equipment (see equipment table, p 77). Most of it is in the power plant itself with the exception of the air-conditioning equipment, which occupies a penthouse area just back of the front-office section.

The power plant is compact, and well laid out. It has three boilers, Fig. 2, fired by single-retort underfeed stokers, with a fourth to be added soon. They all have forced-draft but no induced-draft fans. Two have a steaming capacity of 35,000 lb per hr, each, and the third, 14,000 lb per hr. Steam leaves the boilers at 145 psi and enters one of two headers. The larger of the two handles the winter load from the two 35,000-lb units and the smaller, fed by the 14,000-lb boiler, takes care of the summer house-service needs.

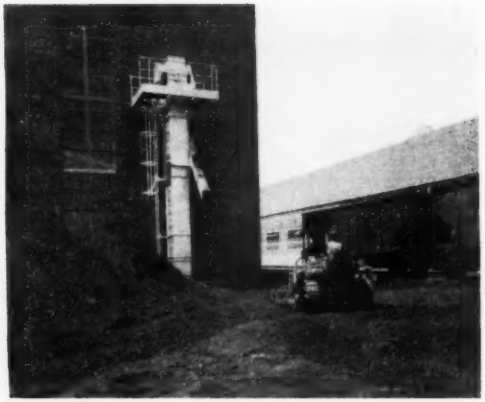
Coming off this 145-lb header, Fig. 4, are two turbine-driven boiler feed pumps. They exhaust to a 5-psi header that supplies steam to a deaerating feedwater heater, Fig. 3. In addition, this 145-lb header delivers steam to a number of reducing valves throughout the plant where steam is dropped to



5 Incoming fresh air for conditioning enters at left of duct work, then passes through filters, a spray room, and over a humidifier into the blower, at right



6 Air leaving blower, Fig. 5, goes to seven unit-air conditioners for zones. Open space serves as the return plenum



7 Bulldozer handles coal movement from cars to storage in the yard or from storage to elevator for bunker delivery

45 psi for various plant purposes.

These reducing valves serve (1) unit heaters in the power plant and the 76 large ceiling-mounted unit heaters in the production plant (2) six converters that change steam to hot water for these purposes: power-plant washroom services, "skin heating" needs in the front-office area, the heating coils in the seven unit air conditioners serving the front offices (3) steam tables and other cafeteria and kitchen equipment (4) four steam-coil-heated hot-water stations throughout the plant for process and plant washrooms.

Condensate Returns. Almost all the steam used by this equipment returns to the deaerator. But the methods of return differ. All unit heaters have trapped returns. Those in the power plant return directly to the deaerator. But those in the production plant after discharging through bucket traps, go to vented condensation-return pump stations and then to the deaerator. The four steam-coil-heated hot-water stations return condensate through bucket traps to condensation-return pumps in this same fashion.

The converters have their hot-water output picked up by pumps and delivered under pressure for their various services. The converter unit supplying hot water to the heating coils of the unit air conditioners has its hot water circulated under 10-15 psi. If the unit conditioner has no need for hot water then the water recirculates. But any passing through the heating coil returns through the condensation mains to the deaerator.

All returns, plus what little city water is needed for makeup, go to the deaerator, Fig. 3. From there, the boiler feed pumps deliver water to the boilers. Separate chemical feed tanks permit mixing the recommended water treatment. Two chemical proportioning pumps feed the mixture to the boiler.

Unit Heaters. The ceiling-mounted unit heaters are equipped with centrifugal fans to give a relatively high velocity discharge of heated air. This high velocity pulls into the discharge-air stream considerable room air, which lowers final heated-air temperature to room-comfort conditions by the time the air stream reaches the working level.

Because the working-area layout stresses a smooth flow of production materials it was decided to mount the unit heaters in the ceiling. Such mounting gives a heat source with transfer surface, piping and returns completely away from work space.

These unit heaters have dampered connections to the outside air with filters installed in the incoming-air path. This permits mixing fresh air with room air in any desired proportion. Moreover, in summer months with the steam disconnected, it introduces under positive pressure a flow of ventilating air. During the heating months a thermostat control cuts the steam supply off and on without shutting down the centrifugal fan. This always assures a definite air movement and avoids any sense of stuffiness.

With all 76 ceiling-mounted unit heaters operating and the 74 exhauster fans in service enough air is introduced to hold the entire plant area under an average pressure of 0.1 wg.

Air Conditioning. Heating load in the front-office area is handled by a split system. The so-called skin-heating needs along the cold outside walls are supplied by unit convectors, hot-water heated from converters, described above. Bulk of the heating load is carried by the air-conditioning system.

This system, Fig. 5, 6, takes in outside air through a louvered inlet in the wall of the air-conditioning equipment penthouse. The louvers are so set that a minimum of 20% of the total air in circulation within the air-conditioning system is always fresh air. Just below the louvered inlets are two units of finned heating tubes large enough to raise incoming air to 50 F from a design load of 0 F.

Floor of this inlet air chamber is made up of dampers through which return air may be introduced in controlled amounts. Any excess or unwanted return air continues through the return plenum and is released to the out-of-doors.

Incoming fresh air or a mixture of fresh and returned air passes through a bank of 77 filters to enter a humidifier room. Here the air goes through a spray of water where its relative humidity can be adjusted. A steam humidifier follows to raise temperature back to 50 F.

The air then enters the main blower and leaves under the control of a vortex damper. This damper regulates outlet pressure of air to 0.4-in. wg before it enters the supply ducts. These ducts split off the main to connect to the seven separate unit air conditioners serving the zones in the front-office area.

Each unit air conditioner, Fig. 6, carries in addition to the main air-supply connection (1) air-inlet opening into the return-air plenum (2) set of filters behind this return-air connection (3) hot-water heating coils for final temperature adjusted in the heating season and (4) yet-to-be-installed chilled-water coils for final temperature control during the summer conditioning load.

These chilled-water coils will draw water from the spray-connection in the humidifier room. A refrigerating compressor and a cooling tower are other

PRINCIPAL POWER-SERVICE EQUIPMENT

Yale & Towne Mfg Co, Philadelphia Div, Pa.

STEAM GENERATION AND AUXILIARIES:

Boilers, 2 ..... Combustion Engineering-Superheater, Inc
35,000 lb per hr, 150 psi, stoker fired
Boiler, 1 ..... Combustion Engineering-Superheater, Inc
14,000 lb per hr, 150 psi, stoker fired
Stokers, 3 ..... Combustion Engineering-Superheater, Inc
Underfeed, single retort, side dump, hydraulic drive
Soot blowers ..... Bayer Co
Flash tank, blowoff ..... Philadelphia Iron Works
Bulldozer ..... Caterpillar Tractor Co
Coal-handling, yard
Coal-conveyor system ..... Beaumont Birch Co
Screw conveyors for coal handling ..... Screw Conveyor Corp
Boiler Instruments:
Gages, feedwater, steam header ..... Crosby Steam Gage & Valve Co
Gages, pressure ..... Manning, Maxwell & Moore Inc
Gages, draft ..... Ellison Draft Gage Co
Water level, panelboard mounted
Combustion control ..... Hagan Corp
Water regulator, Copes ..... Northern Equipment Co
Valves, traps, miscellaneous ..... Crane Co
Reducing valves, 145-45 psi ..... Fulton-Sylphon Div
Fans, forced draft, 1 per boiler ..... Clarage Fan Co
Stack, radial brick ..... American Chimney Corp
Water treatment ..... WH & LD Betz Co
Treatment tank system ..... Milton Roy Co
Proportioning chemical feed pumps
Motor-drive for chemical pumps ..... General Electric Co
Deaerating heater ..... Hoppes Mfg Co

PUMPS AND COMPRESSORS:

Feedwater pumps, 3 ..... Dean Hill Pump Co
2 pumps, steam-turbine-driven ..... Dean Hill Pump Co
Steam-turbine governor ..... Fisher Governor Co
1 pump, motor-driven, 40 hp ..... Century Electric Co
Condensate-return systems ..... Domestic Engine & Pump Co
Power-plant piping tunnel
Motor-plant and pump ..... Peerless Pump Co
Compressors, 3, double acting, motor driven ..... Ingersoll-Rand Co
One, 1300 cfm; one, 970 cfm; one, 720 cfm
Motor-drives for above compressors ..... General Electric Co / Westinghouse Elec Corp
Receiver tank, compressed air ..... Buffalo Tank Corp
Valves, compressed air ..... Walworth Co
Fittings, compressed air ..... Stockham Pipe Fittings Co

HEATING AND AIR CONDITIONING:

Unit heaters, power plant ..... Sturtevant Div, Westinghouse Elec Corp
Propeller type, horizontal and vertical mount
Unit heaters, production plant, 76 ..... Carrier Corp
Centrifugal fan, dampered outside-air connection
Fans, exhaust, 74 ..... American Machine & Metals, Inc
Production plant
Traps, bucket ..... Crane Co
Condensation-return systems ..... Domestic Engine & Pump Co
Pumps for above systems ..... Peerless Pump Co
Hot-water tank stations, 4 ..... Philadelphia Iron Works
500 gal, steam-coil heated
Converters, 6, steam to hot water ..... Paterson Kelley Co
1 converter for power-plant hot water
4 converters for zone "skin heating"
1 converter for unit air conditioners
Pumps, converters ..... Chicago Pump Co
Valves, hot water ..... Jenkins Bros
Fittings, heating ..... Fisher Governor Co
Controls, converters ..... Kieley & Mueller, Inc
Converter gages ..... Ashton Valve Co
Control panel, air conditioning:
Temperature recorder ..... Brown Instrument Co
Thermometers, dial ..... Moeller Instr Co
Controls, zone ..... Minneapolis-Honeywell Regulator Co
Compressor, air-conditioning service ..... Ingersoll-Rand Co
Motor-drive, 7.5 hp ..... General Electric Co
Receiver tank ..... Pressed Steel Tank Co
Filters, inlet air, 77 / Filters, unit air conditioners ..... American Air Filter Co
Heating coils, inlet air ..... John J Nesbitt Co
Duct work ..... Wheeling Corrugating Co / Bethlehem Steel Co
Humidifier, water-spray room ..... Air & Refrigeration Corp
Pump, humidifying water ..... Weil Pump Co
Blowers, main and zone ..... Clarage Fan Co
Air conditioners, unit, 7 ..... Clarage Fan Co
Diffusers ..... Pyle-National Co

ELECTRICAL EQUIPMENT:

Switchgear and panels ..... Westinghouse Elec Corp
Meters, miscellaneous ..... General Electric Co / Sangamo Electric Co
Battery charger, 1 ..... Westinghouse Elec Corp
Batteries, 60 ..... Gould Storage Battery Corp
Generator, auxiliary, gasoline-drive ..... U. S. Motors Corp
Generator, 40 kw, 400 v ..... Columbia Elec Mfg Co
Engine, gasoline ..... Hercules Motor Corp
Breakers, miscellaneous ..... Square D Co / ITE Circuit Breaker Co
Controls, motor, miscellaneous ..... Cutler-Hammer Inc

major air-conditioning equipment yet to be added.

Conditioned air enters the office area through ceiling-recessed diffusers. They emit air in a number of small streams so no draft is felt. Air leaves through grilles to enter the return plenum under pressure of incoming conditioned air.

Compressed Air. Over and above the heating, hot-water and air-conditioning services the power plant handles are the production requirements for compressed air. This air originates in the compressor room from three double-acting compressors, one 1300 cfm, one 970, and the third 720. They deliver to a power plant roof-mounted receiver tank and from here feed the compressed-air lines throughout the plant.

Industrial Wastes. Waste products from industrial process receive every treatment to render them harmless or, in the case of dusts, below any possible nuisance level. The exhausters from the paint chambers pull the fumes out through towers where entrained paints and solids can be removed.

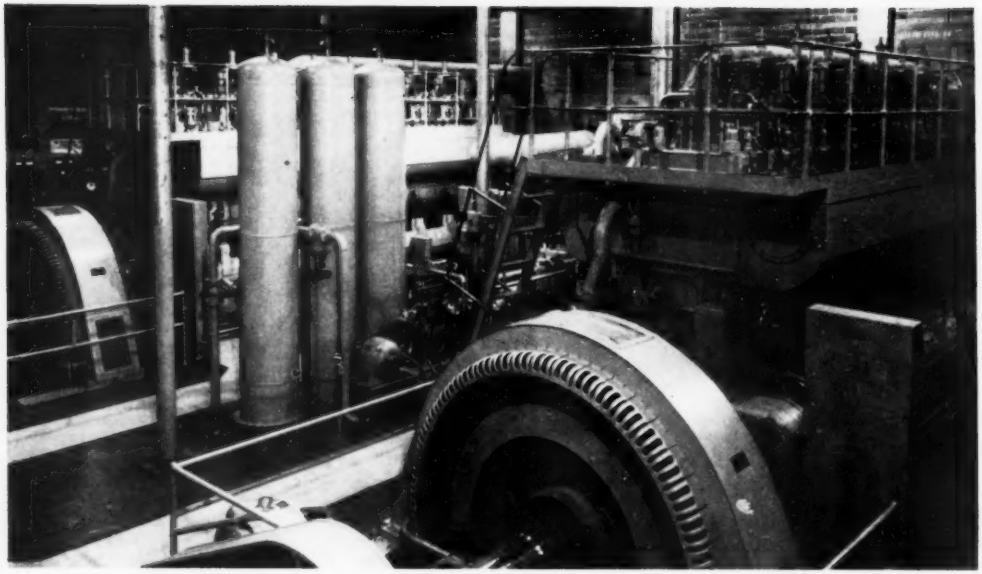
Any dusts or solids lifted from the general machine shop by machine exhausters pass through a battery of dust collectors mounted outside the plant.

Sewage Treatment. Industrial wastes to be eventually dumped in waters undergo considerable treatment. About 100,000 gal of sewage is treated daily. All sanitary sewage passes through a comminutor where solids are ground up. Three pumps, used alternately each week, take the sewage from the manufacturing plant 1800 ft to the sewage-disposal plant. Here it flows into two primary settling tanks of 7700 gal each.

Solids settle out in these tanks and a scraper unit pulls them into a trough. This trough empties into a common sludge hopper by gravity. From the hopper the solids go to a floating-top digester for chemical decomposition. Twice a year the digested solids are run on sand filter beds, allowed to dry and trucked away.

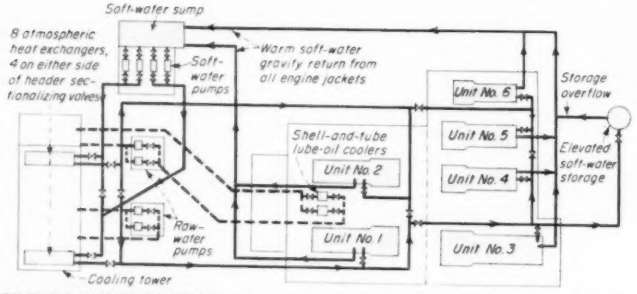
Liquid sewage flows over the weirs of the primary tanks into mixing troughs where it meets activated return sludge. The mixture goes into two 51,000-gal aeration tanks. These tanks pass 200 cfm of air through the mixture. This sewage is aerated to keep the dissolved oxygen content high enough for the bacteria and aerobic animal life present because they consume all the impurities in the sewage.

The aerated sewage flows to two 12,000-gal final settling tanks. The crystal-clear effluent passes over weirs into a tank for chlorination before emptying into a creek. The activated sludge goes back to mixing troughs.

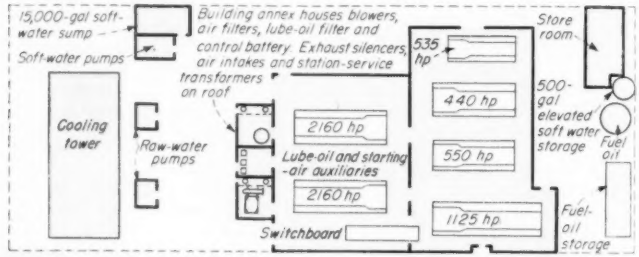


NEW DIESEL GENERATORS, rated at 1500 kw, now burn gas on the full diesel cycle; can also burn fuel oil. For economical piping layout, starting-air tanks and compressors, auxiliary oil pumps, lube-oil coolers and strainers stand between units

Two New Gas-Burning Diesels Triple



COOLING-WATER DIAGRAM shows piping hookup of new cooling tower, heat exchangers and pumps. Soft-water piping is drawn as solid lines; raw-water is dashed



GENERAL PLAN reveals how original building was extended to house new engines. It also shows arrangement of new cooling-water facilities that serve entire plant

► TYPICAL OF MANY CITIES, Tucumcari, New Mexico, faced pressing need for postwar power expansion to meet population growth and increased electrical demands. Result was the tripling of its municipal-plant capacity by addition of two 1500-kw diesel-electric sets designed to burn either fuel oil or natural gas. As part of the expansion program auxiliary facilities and switchgear were extended and modernized.

Back in 1939, when Tucumcari's population was about 5500, the city acquired the local generating station and distribution facilities from private interests. Generating equipment then consisted of three diesel sets (100, 225 and 300 kw) and a spark-ignition gas-engine set of 300 kw. In 1940, a 600-kw diesel unit replaced the 100-kw set,

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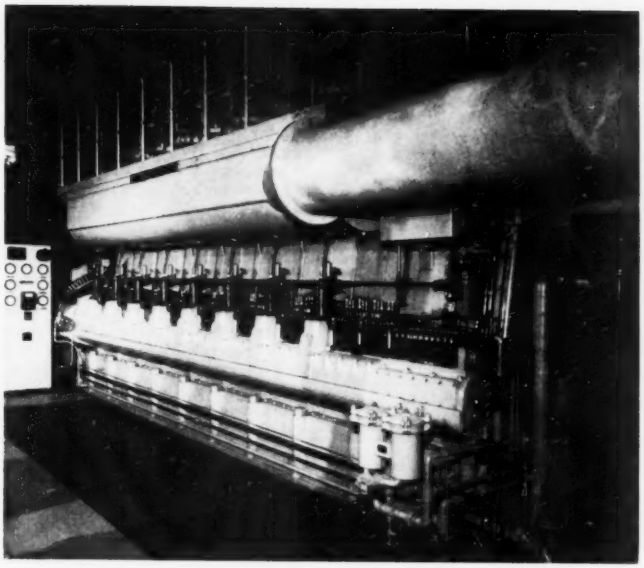
Existing generating equipment includes: an 1125-hp 4-cycle 6-cylinder 22x30-in. 180-rpm DeLaVergne diesel driving a 1000-kva General Electric generator; a 550-hp 4-cycle 5-cylinder 17½x24-in. 225-rpm DeLaVergne diesel driving a 438-kva GE generator; a 535-hp 4-cycle 6-cylinder 15x16-in. 327-rpm Worthington spark-ignition gas engine driving a 412-kva Westinghouse generator; and a 440-hp 2-cycle 4-cylinder 15x21-in. 225-rpm Nordberg diesel driving a 312-kva Westinghouse generator. A Burgess exhaust silencer serves the gas engine; diesels have silencers built by the engine manufacturer. Lube-oil filters for these existing engines are Briggs and Nugent; all engines burning diesel fuel have Nugent fuel filters.



OPERATING SIDE of Unit No. 1 shows individual injection pumps, mechanical lubricators, air-intake manifold. Engine instrument panelboard is at far left of photo

Tucumcari's Capacity

When an irrigation project boosted population and electric demand in this New Mexico city, emergency steps were taken until municipal plant could be extended. J H Bender tells what was done and describes engineering of the station's expansion

bringing total plant capacity to 1425 kw.*

City Grows. In that same year, the Bureau of Reclamation started construction on the 45,000-acre Tucumcari Irrigation Project. But in Dec 1941, before water was available to any irrigable lands of the project, work was suspended. Work began again late in 1945 and water became available to some 8000 acres in 1946. Each succeeding year saw more acreage irrigated. The project is to be finished in 1950. This development brought rapid growth to Tucumcari. In 1948, population was estimated at 12,000.

Expansion Planned. Foreseeing what this growth meant in terms of electrical energy, city officials arranged financing in late 1945 for additional generating capacity. Early in 1946 they let contracts for two 1500-kw 2-cycle gas diesels and auxiliaries, plus a new cooling-water system and modern switchgear to serve the entire enlarged plant.

Slow deliveries and shortages of construction materials delayed the work and by early summer of 1946 it was clear that existing facilities could not supply increasing demand. Leased from War Assets Administration in June 1946, a 500-kw unit was received at Tucumcari in early August, installed in a temporary but substantial building and put in service early in September.

This leased unit was a Baldwin Locomotive Works Type VO 8-cylinder 4-cycle $12\frac{3}{4}$x$15\frac{1}{2}$-in. 514-rpm 730-hp diesel driving an Allis-Chalmers 625-kva 480-v 3-phase 60-cycle generator and exciter. A 450-kva 3-phase transformer raised generator voltage to system distribution level, 2400 v.

Emergency Operation. By operating this generator at or near unity power factor, the 450-kva step-up transformer safely handled the maximum practical load the unit could carry at plant elevation, 4500 ft above sea level. For 16 months this leased unit gave excellent service. When the first of the new 1500-kw units went into regular operation the lease was terminated. Later this unit was shipped to the government-owned Alaska Railway.

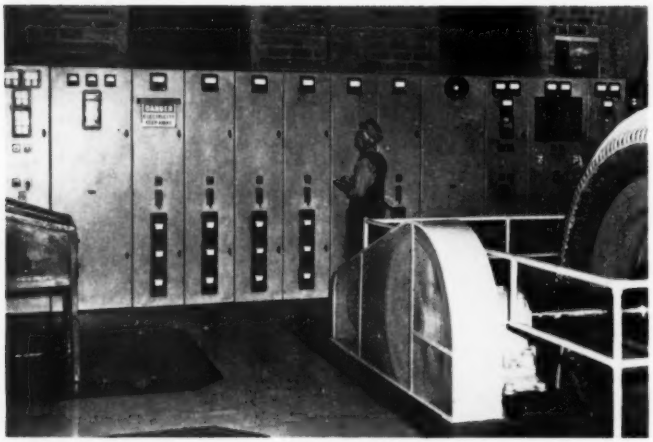
Limited space available for plant expansion, interference between the old cooling facilities and the site of the building addition, and need for keeping the old cooling system in operation presented problems. These influenced design, arrangement of auxiliary equipment and procedure during construction. Necessary temporary work, and its later demolition, raised cost.

First Construction. New cooling tower, heat exchangers and pumps were delivered in April and May 1947. They went into service with the existing plant in August, with piping arranged to serve the new units. This permitted tearing down the old cooling system and building an annex at the side of the new engine-generator room. This annex houses the large motor-driven scavenging blowers for the new 2-cycle engines, air filters and some other auxiliary equipment.

Two sets of motor-driven vertical turbine pumps are set over sumps adjacent to the side of the cooling-tower basin (see plan and piping diagram). Two of these pumps, 1000-gpm 45-ft-head Fairbanks, Morse units, circulate raw water over the tower and eight atmospheric heat exchangers with Admiralty tubes and headers. Two similar pumps, rated 500 gpm at 70-ft head, circulate raw water over the tower and through Struthers-Wells shell-and-tube oil coolers at the new engines. The redwood cooling tower, of the atmospheric type, as well as its heat exchangers, was designed and built by J F Pritchard Co.

Three 540-gpm 95-ft-head motor-driven Allis-Chalmers centrifugal pumps stand in a pit adjacent to the cooling-tower basin. Piping is arranged for a future fourth pump. These pumps circulate soft water through atmospheric heat exchangers and engine jackets. From jackets, all hot water returns by gravity to a 15,000-gal sump and thence to soft-water-pump suctions. Minimum positive suction head is about 5 ft.

Piping Hookup. Jacket-water headers are so looped and valved that repairs can be made with cooling water still available for more than 75% of



MODERN SWITCHBOARD serves entire plant. Visible are, l to r: No. 3 generator panel, totalizing-meter panel, six feeder panels, surge-protection panel, No. 2 generator panel, exciter-control panel for Units 1 and 2, generator panel for No. 1

in-stalled capacity. An existing 5000-gal tank on a steel tower floats on the jacket-water header. This provides 4-5 min supply for loads up to some 2000 kw if all jacket-water pumps should fail. All pumps, located some 60 ft from new engine room, are manually controlled. No cooling-water difficulties have been met in more than 18 months' operation of the system.

A zeolite softener brings jacket water to zero hardness. It is further treated to inhibit corrosion. Raw water is also treated to inhibit corrosion and prevent excessive scale deposits in heat exchangers and oil coolers.

In designing the building addition, we eliminated the customary traveling crane. There were three reasons: (1) Crane couldn't be installed in time to aid in erection of the new units. (2) Material reduction in building cost resulted. (3) Heaviest pieces to be handled in normal maintenance weigh only 3500 lb. Each unit is served by a 5-ton geared trolley and a 2-ton chain hoist, carried on a 12-in. I-beam suspended from the bottom chord of the roof trusses. Roof-truss design permits handling loads up to about 15,000 lb at any point on the I-beam.

Auxiliaries. The two new diesel sets center 14 ft either side of the east-west building center line. This provided ample space for three steel columns for roof-truss midpoint support. Arranging lube-oil strainers, heat exchangers, air-storage tanks and motor-driven auxiliary lube-oil pumps and starting-air compressor between the engines made for an economical piping layout.

The 14,000-cfm 3500-rpm motor-driven Elliott centrifugal blowers for scavenging the new 2-cycle engines are in the building annex at the compressor end of the engines. Depending on atmospheric pressure and temperature conditions, blower motors require from 170 to 220 hp. Motors connect to generator terminals of the units they serve. They start and come up to speed as the engines accelerate. With this hookup, there is need for quickly raising generator voltage to a value that will start the blower motor while the engine is turning on starting air at only 20% normal speed.

The problem is solved by heavily exciting the exciter shunt field for a few seconds from the 120-v switchboard control-battery circuit. This scheme permits using reliable high-speed motor-driven scavenging blowers of relatively low first cost, without need for a separate source of blower-motor energy for starting up.

In the partition wall of the building annex, adjacent to the scavenging-blower suction, there is a bank of American Air Filter Co filters. Outside air supply to each filter compartment comes through two 24-in. stacks in the compartment roof. These stacks take air about 20 ft above ground to avoid some of the dust and dirt of this semi-arid region subject to high winds.

Another room of the building annex, between the two blower and air-filter rooms, contains an auxiliary high-pressure motor-driven 3-stage gas compressor, a 10-gpm Hoffman lube-oil filter serving both new engines, sinks and racks for cleaning air-filter sections, and station switchboard 120-v control battery, plus charging rectifier.

The Maxim exhaust silencers for the new engines mount on the building-annex roof directly above the scavenging blowers. These require no intake silencers. The building-annex roof also carries the 2400/480-v station-service transformer bank and a smaller 2400/240/120-v bank serving a few auxiliaries and plant lighting.

Two 250-gpm motor-driven Blackmer rotary oil pumps and two basket-type Elliott duplex oil strainers serve the new 2160-hp engines.

Engine-Generators. The two new Nordberg 8-cylinder 2-cycle 17½x25-in. 277-rpm gas-diesels drive 2000-kva Elliott generators with 25-kw V-belted exciters. Designed for either oil or gas fuel, they are at present burning natural gas. This comes from local mains at 25-30 psi. A 3-stage reciprocating compressor, integral with each engine, raises gas pressure to 1150-1200 psi for injection just before end of compression of the cylinder air charge. Injection of a small quantity of pilot oil stabilizes ignition. Gas is burned on the full diesel cycle. A gas scrubber of about 35,000-cfh capacity removes any moisture, dirt, or pipe scale that might be in the gas stream.

Natural gas comes from the Texas Panhandle, has a heating value of about 950 Btu per cu ft. Gas consumption has averaged close to 12 cu ft per kwhr generated, metered at the switchboard. This is on loads not particularly favorable for best fuel economy. Pilot oil use runs about 150 gal per 24 hr in each unit, about 7-8% of total heat supplied in fuel.

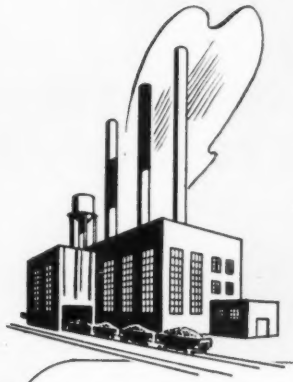
These engines have a sea-level rating of 2160 hp (1500 kw) after driving their own scavenging blowers and gas compressors. Nominal rating at Tucumcari's 4500-ft altitude is about 1320 kw. Only rarely have loads in excess of 1250 kw been carried on either unit for a sustained period. Op-

(*Continued on page 220*)

CORRECTION

In the article "French Develop Free-Piston Engines" (Jan, pp 79-81) an error in metric conversions resulted in incorrect cylinder dimensions. These should be as follows: power-cylinder bore, 13.4 in.; compressor-cylinder bore, 35.4 in.; effective stroke on test, 17.44 in. References to exhaust pressure of 75 psi were illustrative; the full-load pressure on test was 49.7 psig.

1949 MODERN PLANT SURVEY



Tables list engineering features of over 450 new utility and industrial steam plants, more than 175 hydroelectric units. Summaries spot design trends of recent recordbreaking years

THE GREATEST PERIOD of construction activity the power field has ever experienced continues unabated. The year 1948 saw almost 6 million kw added to our national power plant; 1949 and 1950 look to be about 10% higher. Figures now available show about 4.7 kw on order for 1951.

Such a period of activity presents an unparalleled opportunity to see where we are headed in power-plant practice. In this vast program virtually all types of construction are involved: new plants, extensions, and "tops"; indoor, semi-outdoor and outdoor designs; large plants and small; a wide variety of heat-balance arrangements, plant layouts and equipment selections.

From such a large body of data, relatively reliable conclusions can be drawn. We can see the wide adoption of practices that have proved successful, the gradual abandoning of those not so well received.

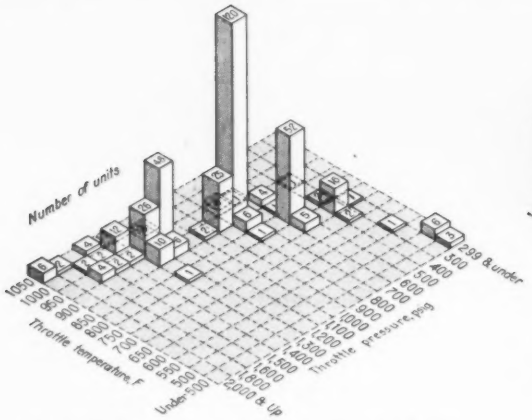
The only drawback lies in the fact that the very volume of activity means that most of us are too busy to take the "long look" needed to spot trends and arrive at answers to guide our planning.

It is to meet this need that POWER makes its survey of new-plant construction. Here we do two things to serve the interests of power engineers: (1) We gather, and compile in convenient tabular form, technical details on units currently on order, under construction, or beginning operation. (2) We analyze the survey returns, and other data available to us, to show at a glance what design and equipment-selection patterns are emerging.

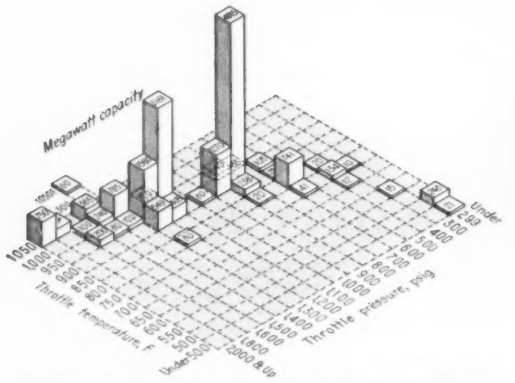
To broaden the basis for these trend-spotting summaries, this year we have included data on the past two years, each a record-breaker in its own right. This means that the comparisons and conclusions grow out of the largest volume of plant data ever available for analysis.

Here are facts and figures you can sink your teeth into, facts and figures on which to base the decisions you will have to make when you build a new plant, extend or modernize an older one.

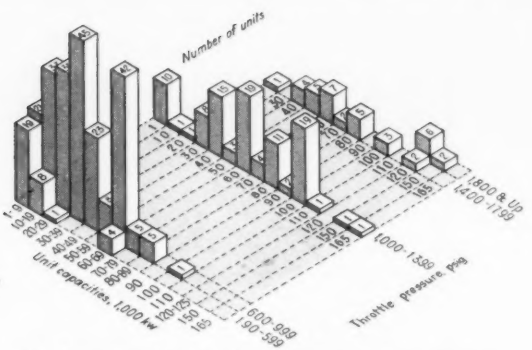
SEPTEMBER 1949 POWER P W SWAIN, EDITOR



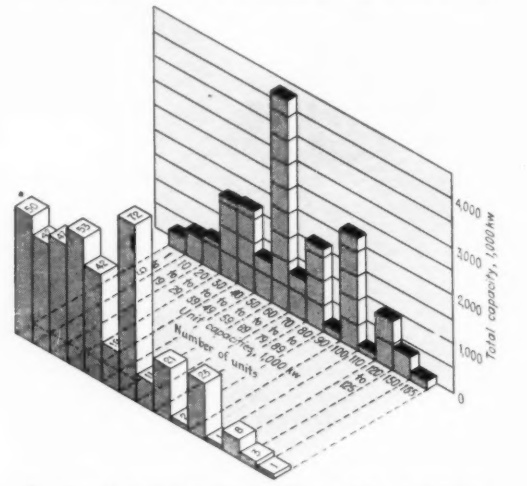
1 Most of new units use relatively conservative throttle pressures and temperatures centering on preferred standard



2 Capacity-wise, higher throttle conditions are slightly more predominant, reflecting larger turbine unit sizes



3 Largest number of turbine-generator units use pressures in the 600-to-999-psig range, are 60,000-kw and smaller



4 Though greatest number of units are of the smaller capacities, larger units develop a greater over-all capacity

New Central-Station Trends Emerge

► The current survey (pp 84-87) reports on 156 privately owned and 32 municipal central-station installations. These, together with those reported in the 1947 and 1948 surveys, cover about 90% of the 18,920,000 kw of steam-electric capacity installed or planned for the years 1948 to 1951, inclusive. Figures 1 to 8 refer to installations of the 4-year period, but exclude municipal plants.

New Features. Hudson Ave Station, Consolidated Edison Co of N. Y., largest steam-electric station in the world, will set a new record by installing a 1,300,000-lb-per-hr steam generator operating at 1500 psig and 1050 F to feed a 65,000-kw topping turbine.

Largest turbines reported are the 165,000-kw 1800-rpm unit at the Richmond Station of Philadelphia Electric Co and three 150,000-kw units for Commonwealth Edison Co. The Fisk Station unit will operate at 1800 rpm and the two Ridgeland Station units are cross-compound with 3600-rpm h-p elements and 1800-rpm l-p elements.

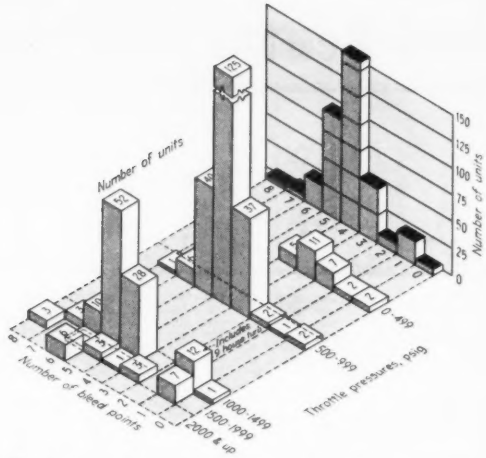
High Temperature. A total of 13 units with aggregate capacity of 1,475,000 kw will use 1050-F throttle steam at pressures of 1450 psig to 2000 psig. Reheating will be used in 26 units with a total capacity of 2,195,000 kw. Reheat temperatures vary from 835 to 1000 F.

During the 4-year period, ten topping units, two of which exhaust to steam-distribution systems, will be installed. A total of 11 house turbines will be put to work, a revival of an old trend. Many of these are on systems having hydro plants as a major source of energy.

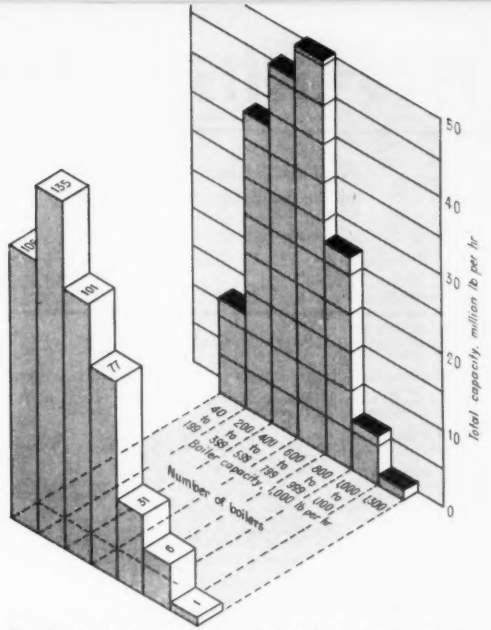
An interesting step is the elimination of induced-draft fans on three oil- and gas-fired installations. Furnaces will be pressurized and induced-draft furnished by blowers.

Of the 381 central-station units, 31 of those with 7500-kw capacity and above will have air-cooled generators. All the rest will have hydrogen cooling.

Fig. 4 shows the large number of 60- to 65-mw units being installed. They are about 19% of the total number and



5 Four bleed points are still most often used in regenerative feedwater-heating cycles, three units use eight points



6 Boiler sizes parallel turbine sizes in respect to number and total capacities. Note new 1,300,000-lb-per-hr unit

about 26% of the total capacity. Units below 60 mw represent 63% of total number but only 34% of total capacity. Units above 65-mw have 18% of total number and 40% of total capacity.

Fig. 5 demonstrates the continuing popularity of 4-bleed-point regenerative cycles. These predominate in the intermediate-pressure units. Three units use eight bleed points. Of the 22 units using one bleed point, 9 are house turbines, usually of the automatic-extraction type.

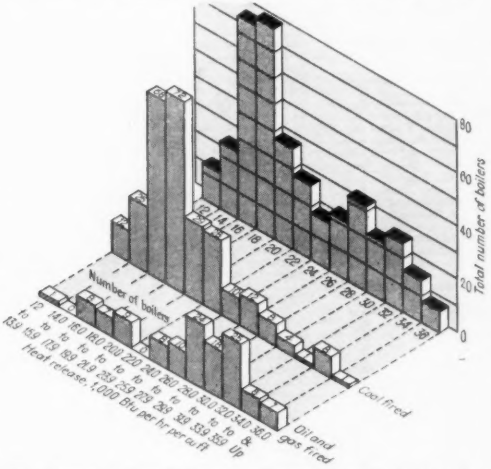
Boiler Data. According to Fig. 6, about 75% of the 457 boilers have capacities under 600,000 lb per hr, representing 53% of total boiler capacity. Boilers 600,000 to 975,000-lb-per-hr capacity represent about 24% of total number and 43% of total steaming capacity. Seven boilers of 1,000,000 lb per hr and over prove to be less than 2% of total number, but 4% of total capacity.

Fig. 7 shows that about 64% of the coal-fired boilers will have furnace heat releases of less than 20,000 Btu per cu ft per hr, while 87% will have heat releases below 26,000. Most of the coal-fired boilers with higher rates are in the smaller steaming-capacity range. About 54% of the oil- and gas-fired boilers have heat releases ranging from 28,000 to 34,000 Btu per hr per cu ft.

Less than 1% of the boilers (all small capacity) have neither economizer nor air heater, see Fig. 8. About 56% of all boilers use both heat-recovery devices. Pulverized-coal firing still predominates; 56% of the boilers use this form of heat input, either exclusively or in combination with oil and gas.

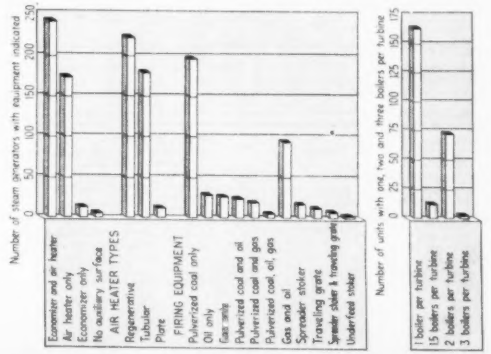
About 66% of the units have only one boiler; 29% have two boilers. The remainder have 1½ boilers, excepting two, which have three boilers per turbine.

Miscellaneous. In collecting the data for the present survey some additional questions were asked. The answers below apply only to the 156 plants reporting this year. Eight units are completely outdoors, 34 have outdoor boilers and 21 have some of their auxiliaries outdoors. Units having completely centralized control—boiler, turbine and electrical—number 53. Of 86 coal-fired boilers, 7 have no dust collectors, 45 use the mechanical type, 17 the electrostatic type, while 7 use a combination of both. Only four units were reported using rotary pumps for condenser air removal. Twelve units use condenser deaeration of feed exclusively; all others use deaerating heaters at less than 110 psig.



7 Furnace heat-release rates concentrate below 24,000 Btu per cu ft per hr for most coal-fired steam generators

8 Heat-recovery auxiliaries and pulverized-coal firing are used in majority of steam generators installed or planned



1949 Listing of Typical Central-Station

For notes on uses and limitations of this tabulation • See page 96

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name	Consulting Engineers	First Operation, New Units	Nominal Pressure, psi	Nominal Steam Temperature, F	BOILERS: Number	Capacity, each, 1000 lb per hr	Manufacturer	Boiler, Waterwall Surface, 1000 sq ft	Superheater Surface, 1000 sq ft	Furnace Volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace Bottom
1500 PSIG AND ABOVE														
Indiana & Michigan Elec Co	Lawrenceburg, Ind	Tanners Creek	Amer Gas & Elec Serv	12-50	2000	1050[1]	1	930	BW	29.6	60.5[5]	79.8	16.4	DB
Appalachian Electric Pwr Co	Graham Sta, W. Va	Philip Sporn	Amer Gas & Elec Serv	7-51	2000	1050[1]	1	930	BW	29.6	60.5[5]	79.8	16.4	DB
				10-51	2000	1050[1]	1	930	BW	29.6	60.5[5]	79.8	16.4	DB
Commonwealth Edison Co	Stickney, Ill	Ridgeland	Sargent & Lundy	9-50	1800	1050	2	730	BW	19.3	44.9	35.4	24.1	ST
				9-51	1800	1050	2	730	BW	19.3	44.9	35.4	24.1	ST
Central Hudson Gas & El Corp	Danskammer Pt, N. Y.		Burns & Roe, Inc	1-52	1650	1000[1]	1	500						DB
Consolidated Edison Co of N. Y	Brooklyn, N. Y	Hudson Ave		9-51	1500	1050	1	1300	BW	21.6	50.2	76.7	20.6	DB
1000 TO 1499 PSIG														
Pennsylvania Power Co	West Pittsburgh, Pa	New Castle	Commonw & Southern	10-51	1450	1000[1]	1	600	BW	14.8	52.0	52.3	18.0	DB
Boston Edison Co	Weymouth, Mass	Edgar	Jackson & Moreland	8-49	1450	1000[1]	1	585	CE	14.8	33.0	42.0	17.3	DB
Rochester Gas & Electric Corp	Rochester, N. Y	Russell	Gilbert Associates, Inc	10-51	1450	1000[1]	1	430	CE	20.7			19.4	DB
Con Gas Elec Lt & Pow Co, Balt	Turner, Md	Riverside		10-51	1450	1050	1	625	BW	11.7	24.1	43.0	18.1	DB
Dayton Power & Light Co	nr Miamisburg, Ohio	O H Hutchings	Ebasco Services, Inc	1950	1450	1000[1]	1	430	CE	20.7		30.4	19.5	DB
Central New York Power Corp	Oswego, N. Y	Oswego		1951	1450	1000[1]	1	656	BW	12.4	54.9	40.3	22.2	ST
N.Y. State Elec & Gas Corp	Johnson City, N. Y	Goudey	Gilbert Associates	1951	1450	1000[1]	1	560	CE	29.3	34.7[6]	44.6	17.0	DB
Potomac Electric Power Co	Washington, D. C	Benning			1450	1000	1	675	CE	30.7		55.4	14.4	DB
Wisconsin Electric Power Co	Port Washington	Port Washington		1951	1450	950[10]	1	640			16.0	61.0	12.8	DB
	Bakersfield, Calif	Kern	Stone & Webster		1350	925	2	450	BW	9.2	15.2	18.4	30.3[13]	
Pacific Gas & Electric Co	Moss Landing, Calif	Moss Landing	Stone & Webster		1300	950	6	475	BW	9.9	20.4	52.0	18.3[15]	
	Antioch, Calif	Contra Costa	Bechtel Corp	1951	1300	950	6	475	CE	25.8	26.2	34.7	16.9	
Florida Power Corp	Booth Point, Fla	Higgins	The Kuljian Corp	2-51	1315	950	1	450	BW	5.8	16.1	20.0		DB
	St. Peters-burg, Fla	Bayboro	The Kuljian Corp	12-49	860	910	1	330	BW					DB
The Detroit Edison Co	Detroit, Mich	Connors Creek		4-51	1300	950	4	600	BW	12.0	26.7	40.0	18.3	DB
Cambridge Electric Light Co	Cambridge, Mass	Kendall Sq	Gilbert Associates, Inc	12-50	1300	900								
Kansas City Power & Light Co	Kansas City, Mo	Northeast		11-49	1275	825[17]	1	375	FW	16.0	13.8	26.4	18.1	DB
		Hawthorn	Ebasco Services, Inc	1950	1250	950	2	625	CE	28.4	23.5	45.8	16.9	DB
New Jersey Power & Light Co	Holland, N. J	Gilbert	Gilbert Associates, Inc	10-49	1250	950	1	650	CE	27.8	25.5	49.5	16.0	DB
Illinois Power Co	nr Alton, Ill	Wood River	Sargent & Lundy	12-49	1250	1000	2	450	CE	22.1	28.4	30.6	17.8	DB
				12-50	1250	1000	1	450	CE	22.1	28.4	30.6	17.8	DB
Union Electric Co of Missouri	St. Louis County, Mo	Meramec		1952	1250	950[10]	1							
Duke Power Co	Pelzer, S. C	Lee		12-50[18]	1250	950[10]	2	750	CE	38.5	32.5[19]	63.0	15.6	DB
Pennsylvania Power & Light Co	nr Sunbury, Pa	Sunbury	Ebasco Services, Inc	5-51	1250	950	1	800	FW	26.1	50.4	82.4	12.1	DB
Carolina Power & Light Co	Lumberton, N.C	Lumberton	Ebasco Services, Inc	9-49[22]	1250	950	2	425	BW	9.2	15.7	30.0	18.0	DB
Louisiana Power & Light Co	nr Westwego, La	Ninemile Point	Ebasco Services, Inc	4-51	1250	950	1	650	CE	22.1	16.8	33.3	27.1	
Montauk Electric Co	Somerset, Mass	Somerset	Stone & Webster	9-51	1250	950	1	625	CE	28.2	22.3	45.2	16.0	DB
Virginia Electric & Power Co	Bremo Bluff, Va	Bremo	Stone & Webster	1950	1250	950	1	625	BW	12.0	26.8	40.0	19.4	DB
Delaware Power & Light Co	Wilmington, Del	Edge Moor	United Eng & Const	1951	1250	950	2	600	CE	37.9	21.7		16.8	DB
Georgia Power Co	Yates, Ga	Yates	Commonw & Southern	1950	1250	950	2	975	CE	40.9	36.2	74.0	15.4	DB
Alabama Power Co	Gorgas, Ala	Gorgas	Commonw & Southern	1951	1250	950	1	975	BW	17.0	32.5	58.9	19.4	DB
Utah Power & Light Co	Salt Lake City, Utah	Salt Lake City	Bechtel Corp	1951	1250	950	1	620	RS	38.5	35.5	49.0	15.1	DB
Philadelphia Electric Co	Philadelphia, Pa	Richmond		1950	1250	950	2	800	CE	36.5	32.4	60.0	15.5	DB
Dallas Power & Light Co	Dallas, Texas	Parkdale	Ebasco Services, Inc	5-52	1250	950	1	625						
Omaha Public Power District	Omaha, Nebr	Jones Street		7-49	1250	950	1	330	BW	11.2	14.0	24.0	17.3	DB
Northern Indiana Public Serv Co	Michigan City, Ind	Michigan City	Sargent & Lundy	10-50[25]	1250	950	3	375	BW	9.8	17.0	16.7	28.0	ST
Cincinnati Gas & Electric Co	Cincinnati, Ohio	Miami Fort	Sargent & Lundy	11-49	1250	950	2	400	BW					DB
Mississippi Power & Light Co	Jackson, Miss	Rex Brown	Ebasco Services, Inc	11-49	850	900	1	450	CE	23.7	7.3	21.0	29.6	
				12-49	1250	950	1	650	BW	16.3		36.3	25.0	
	Natchez, Miss	Natchez	Ebasco Services, Inc	2-51	1250	950	1	625	BW	16.3		36.3	24.1	
800 PSIG TO 999 PSIG														
Illinois Power Co	nr Havana, Ill	Havana	Sargent & Lundy	12-48	850	900	1	285	CE	19.2	11.6	20.2	18.0	DB
				4-50	850	900	2	285	CE	19.2	11.6	20.2	18.0	DB
				6-50	850	900	2	285	CE	19.2	11.6	20.2	18.0	DB
El Paso Electric Co	El Paso, Texas	Rio Grande	Stone & Webster	3-51	850	900	1	335	BW	23.1		34.9	22.2	DB
The Cleveland Elec Illum Co	Cleveland, Ohio	Lake Shore-A		11-50	850	950	2	680	BW	17.5	19.9	34.7	23.8	ST
	Avon Lake, Ohio	Avon		8-49	850	950	2	850	CE	35.3	27.6	64.0	16.2	DB
Wisconsin Public Service Corp	Green Bay, Wis	Pulliam	Pioneer Serv & Engng	9-49	850	900	1	460	BW	12.2	18.2	26.6	22.5	
				1951	850	950	1	585	BW	13.6	28.4	39.5	19.0	
Florida Power & Light Co	Sarasota, Fla	Sarasota	Ebasco Services, Inc	12-50	850	900	1	235	CE	23.0		11.8	25.1	
Gulf Power Co	Pensacola, Fla	Pensacola	Commonw & Southern	8-49	850	900	1	230	RS	19.6	6.6	13.4	22.3	DB
Georgia Power Co	Albany, Ga	Mitchell	Commonw & Southern	11-48	850	900	1	230	BW	21.7	6.6	16.3	17.2	DB
				3-49	850	900	1	230	BW	21.7	6.6	16.3	17.2	DB
	Atlanta, Ga	Atkinson	Commonw & Southern	11-48	850	900	1	600	CE	28.4	13.7	35.0	21.0	DB
	Arkwright, Ga	Arkwright	Commonw & Southern	11-48	850	900	1	400	BW	9.8	10.4	22.3	22.5	DB
Texas Electric Service Co	Fort Worth, Texas	Handley	Ebasco Services, Inc	10-50	850	900	1	825	CE	47.2	14.6	43.1	26.0	DB
	Colorado City, Texas	Morgan Creek	Ebasco Services, Inc	4-50	850	900	2	220	FW	21.0	7.1	8.6	35.7	DB
Dallas Power & Light Co	Dallas, Texas	Mountain Creek	Ebasco Services, Inc	5-49	850	900	1	450	BW	26.9	8.5	19.9	31.1	
							1	250	BW	17.8	7.2	11.7	29.0	
		Dallas	Ebasco Services, Inc	1-51	850	900	1	675	CE	41.6	12.6	37.3	26.0	
		Gable Street	Ebasco Services, Inc	3-50	850	900	1	350	RS	18.8	11.0	14.6	33.1	
Houston Lighting & Power Co	Houston, Texas	West Junction	Ebasco Services, Inc	6-50	850	900	1	825	RS	38.8	19.4	36.6	31.0	
				2-51	850	900	1	825	RS	38.8	19.4	36.6	31.0	
				1948	850	900	1	325	BW	23.0	7.9	16.1	27.2	
Central Arizona Light & Power Co	Phoenix, Arizona	Phoenix	Ebasco Services, Inc	1949	600	825	1	150	CE	12.0	3.2	6.1	32.3	
				1950	850	900	1	675	CE	41.5	12.7	37.3	25.2	
Texas Power & Light Co	Trinidad, Texas	Trinidad	Ebasco Services, Inc	11-49	850	900	2	350	BW	25.8	13.3	22.2	21.8	DB
Kentucky Utilities Co	Pineville, Ky	E. Park	Sargent & Lundy	7-51	850	900	1	325	BW	28.9	12.1	24.4	16.8	
Southwestern Gas & Elec Co	Mooringsport, La	Lieberman	Sargent & Lundy	4-49	850	900	1	250	BW	18.9	6.3	13.2	25.0	DB
	Easton, Texas	Knox Lee	Sargent & Lundy	12-50	850	900	1	300	BW	21.5	7.8	13.2	31.2	
Central Power & Light Co	Laredo, Texas	Laredo	Sargent & Lundy	5-51	850	900	1	330	BW	21.5	7.8	13.2	31.2	

A —Air cooled
AlBr —Arsenical aluminum-brass
Ad —Arsenical admiralty
AlB —Aluminum-bronze
AlBr —Aluminum-brass
AC —Allis-Chalmers Mfg Co
AsCu —Arsenical copper
Ad —Admiralty
AdI —Admiralty, inhibited
AdCu —Admiralty copper
AnAd —Antimony-admiralty
BB —Brown, Boveri & Co, Ltd
BW —Babcock & Wilcox Co
C —Coal, bituminous
CE —Combustion Engineering-Superheater, Inc
Cu —Copper
CP —Controllable-pitch blower
Cy —Cyclone furnace
D —Damper
DB —Dry bottom
DL —DeLaval Steam Turbine Co
EC —Erie City Iron Works
E —Elliott Co
EM —Edge Moor Iron Works, Inc
FW —Foster Wheeler Corp
G —Natural gas
GE —General Electric Co
H —Hydrogen cooled
Hg —Hydraulic coupling
K —E Keeler Co
L —Lignite
M —Motor drive
Mg —Magnetic coupling
MI —Murray Iron Works Co
M —Two motors per fan
M —One motor, one turbine per fan
Mn —Muntz metal
O —Oil
P —Pulverized coal fired
Pa —C A Parsons & Co, Ltd
PAd —Phosphorized admiralty
PB —Phosphor bronze
Pl —Plate
R —Regulator
RB —Red brass
Re —Regenerative
RS —Riley Stoker Corp
S —Speed control
SP —Springfield Boiler Co
SS —Spreader stoker
ST —Slag tap

and Municipal Power-Plant Installations

Economizer Surface per Boiler, 1000 sq ft	Air-Heater Surface per Boiler, 1000 sq ft	Air-Heater Type	F-D FANS: Drive	F-D FANS: Air-Volume Control	I-D FANS: Drive	I-D FANS: Gas-Volume Control	FUEL: Firing	FUEL: Type	FUEL: Heating Value, 1000 Btu per lb	FUEL: Ash-Softening Temperature, F	FEED-PUMPS: Drive	FEED-PUMPS: Flow Control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Back-pressure, psia	TURBINES: No. of Bleed Points	Generator Cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. Water Passes	CONDENSERS: Tube Material	Total Boiler Capacity Incl New Units, 1000 lb	Total Generator Capacity Incl New Units, 1000 kw
14.3	281.4	Re	M	V	M	V	P	C	11.4	2300	3M		125	3600[2]	GE	0.5	6	H	65	1	AsCu	930	125
14.3	281.4	Re	M	V	M	V	P	C	11.4	2300	3M		125	3600[2]	GE	0.5	6	H	65	1	AsCu	2790	375
14.3	281.4	Re	M	V	M	V	P	C	11.4	2300	3M		125	3600[2]	GE	0.5	6	H	65	1	AsCu	3720	500
10.8	155.5	Tu	M	V	M	V	Cy	C	10.0	2000	2M, 1T	R	150	3600[2]	WE	0.5	5	H	100	1	Ad	1460	150
10.8	155.5	Tu	M	V	M	V	Cy	C	10.0	2000	3M	R	150	3600[2]	GE	0.5	5	H	100	1	Ad	2920	300
.....	.....	Tu	M	V	M	S	P, O	C, O	.....	.....	2M		60[4]	3600	GE	0.5	6	H	.....	1	Ad	500	60
68.5	354.4	Re	M	V	M	V	P, O	C, O	14.4	2050	2M, 1T		65	3600	WE	400[5]	1	H	.....	.....	.....	11,240	835
14.3	227.0	Tu	M	D, Hy	M	D, Hy	P	C	11.0	2100	2M	Hy	85	3600	WE	0.75	5	H	47.5	2	AnAd	1590	173
13.3	157.8	Re	M	V	M	S	P, O	C	13.9	2600	2M	R	81.3	3600	WE	0.5	5	H	45.0	1	AlBr	2378	245
5.4	128.0	Re	M	V	M	V	P	C	12.8	2100	3M	R	50	3600	GE	0.5	6	H	32.5	2	Ad	930	90
13.2	109.6	Re	M	V	M	Hy	P	C	12.5[6]	2400	2M	R	60[7]	3600	GE	0.5	5	H	55	2	AA1Br	2275	255
5.4	46.6	Re	M	V	M	Ma	P	C	13.0		3M	R	60[8]	3600	GE	0.75	6	H	45	2	Ad	1500	180
8.1	246.8	Re	M	.....	M	.....	P	C	13.1	2050	3M	Hy	80	3600	GE	0.5	7	H	50	1	Ad	3306	320
13.3	230.0	Re	M	V	M	V	P	C	12.9	2600	2M	Hy	60[7]	3600	WE	0.5	5	H	42.5	2	AAd	1684	159
23.8	122.5	Tu	.....	.....	.....	.....	P	C, O	13.0	2000	.....	.....	25	3600	GE	400	.....	H	.....	.....	.....	.....	260
0	259.2	Re	M	Ma	M	Ma	P	C	12.6	2156	2M, 1T		80	1800	AC	0.25	5	H	83.7	1	AAd	3365	400
6.9	67.6	Tu	M	D, V	M	D	O, G	O, G	18.5[12]	.....	2M	R	100	1800	GE	1.4	4	H	35	1	PAd	1800	175
9.1	76.4	Re	M	D, V	M	D	O, G	O, G	.....	.....	8M	R	7.5	3600	GE	2.0	1	A					
													100[13]	3600	GE	.....	4	H					
													100	3600	WE	.....	4	H	50	1	.....	2850	300
17.8	69.8	Re	M	D, V	.....	D	O, G	O, G	18.5[12]	.....	8M	R	7.5[13]	3600	GE	2.0	1	A					
													100[13]	3600	GE	0.75	4	H	50	1	.....	2850	300
10.9		Tu	M	V	M	D	O	O	18.4			R	7.5[13]	3600	GE	2.0	1	A					
	72.2	Re	M	V	M	D	O	O	18.4		M	R	44	3600	GE	1	5	H	32.5	1	AlBr	450	44
15.1	142.2	Re	M	Hy	M	Hy	P	C	11.6	2100	3M	Hy	12.5	3600	WE	1	3	A	10	1	AlBr	898	56
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100[14]	1800	WE	0.5	5	H	60	1	Ad	6030	515
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20[15]	3600	WE	0.5	1	H	17.0	2	A1Br	400	32
4.9	114.9	Re	M	V	M	Hy	P, G	C, G	10.3	1900	1T	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	2275	166
22.4	228	Re	M	V	M	Ma	P	C	10.5	1550	2M		60[8, 16]	3600	GE	1.0	5	H	60	2	AsCu	1250	132
18.7	146.4	Re	M	V	Mp	V	P	C	13.0	2000	3		60[8]	3600	GE	0.5	5	H	50	2	Ad	1150	121
8.7	95.1	Tu	M	Hy	M	Hy	P, G	C, G	10.7	1950	3M, 7T	R	40[14]	3600	GE	0.5	5	H	30	1	AsCu	900	80
8.7	95.1	Tu	M	Hy	M	Hy	P, G	C, G	10.7	1950	1M, 1T	R	40	3600	GE	0.5	5	H	30	1	AsCu	1350	120
.....	.....	.....	.....	.....	.....	.....	.....	C	.....	.....	.....	.....	110	3600	WE	.....	.....	.....	.....	.....	.....	.....	.....
15.6	181.6	Re	M[18]	V	M[18]	Ma	P	C	12.5	2300	4M	R	90[14]	3600	GE	0.75	6	H	65	2	AsI	1500	180
24.0	165.6	Re	M	V	M	Ma	P	C[21]	13.7[22]	2100	3M		100	3600	WE	0.75	5	H	60	2	Ad	2400	250
16.6	112.6	Re	M	Hy	M	Hy	P	C	13.8	2100	3M	R	40[8, 14]	3600	GE	1.12	5	H	37.5	2	AsCu	850	80
15.7	76.0	Tu	M[24]	D, V	M[24]	D, V	O, G	O, G	1000[25]		3M	R	60[8]	3600	GE	0.75	4	H	55	2	Ad	650	60
22.0	88.4	Re	M[18]	V	M[18]	Hy	P	C, O	11.7	2200	3M	R	60[8]	3600	GE	0.75	5	H	47.5	2	CuNi	2195	205
17.4	119.6	Re	M[18]	V	M[18]	V	P	C	13.6	2300	3M	Hy	60[8]	3600	WE	0.75	5	H	47.5	2	Ad	1025	90
18.3	140.0	Tu	M	V	M	S	P	C	.....	.....	6M	Hy	60[8, 14]	3600	GE	0.75	5	H	40.0	1	AlB	1200	120
35.7	297.0	Re	M	Hy	M	Hy	P, G	C, G	12.0	2500	3M	Hy	100[14]	3600	GE	1.75	5	H	81.5	2	AAd	1950	200
34.2	289.2	Re	M	Hy	M	Hy	P	C	11.7	2550	3M	Hy	100	3600	WE	1.5	5	H	81.5	2	AAd	2375	220
8.1	138.6	Re	M[18]	V	M[26]	D	.....	C, O, G[27]	.....	1950	2M, 1MT	R	60[8]	3600	WE	1.25	5	H	37.5	1	Ad	620	60
22.7	196.4	Re	M	V	M	V	P, O	C, O	12.7	2000	2T	S	165	1800	GE	1.0	4	H	75.0	1	Ad	4840	450
.....	.....	.....	.....	.....	.....	.....	O, G	O, G	1080[23]	.....	2M		60	3600	GE	.....	.....	.....	60	2	AsCu	625	60
7.2	67.5	Re	M	V	M	Hy	P	C, G	11.4	1900	1M, 1T	Hy	30	3600	GE	0.5	4	H	30	2	AsCu	1700	137
9.4	85.0	Tu	M	D	M	D, Hy	Cy	C	10.8	2100	3M, 1T		60[8, 14]	3600	WE	0.5	5	H	42.5	1	AdCu	1950	208
.....	.....	Re	M	V	M	Hy	P	C	12.5	.....	3M	R	80	3600	.....	0.5	4	H	55	2	.....	.....	340
0	66.6	Tu	M	V	M	D	G	G	1050[23]	.....	1M, 1T		40[8]	3600	WE	1.25	4	H	40	2	Cu	800	77
35.8	.....	Re	M	D	M	D	G	G	1050[23]	.....	3M		60[8]	3600	WE	1.25	4	H	55	2	Cu	1450	143
.....	.....	Re	M	D, V	M	D, V	G	G	1050[23]	.....	3M	R	60[8]	3600	WE	.....	5	H	55	2	AsCu	625	60
0	51.4	Tu	M	Hy	M	Hy	P	C	10.3	.....	1M, 1T	R	40	3600	GE	0.5	4	H	30	1	.....	1140	120
0	51.4	Tu	M	Hy	M	Hy	P	C	10.3	.....	2M	R	40	3600	GE	0.5	4	H	30	1	.....	1710	160
0	51.4	Tu	M	Hy	M	Hy	P	C	10.3	.....	2M	R	40	3600	GE	0.5	4	H	30	1	.....	2280	200
0	61.2	Re	M	D, V	M	D	G, O	G, O	1100[23]	.....	2M	R	30	3600	WE	0.75	4	H	25	2	Ad	1074	94
21.2	263.8	Re	M[18]	V	M[26]	V	P	C	11.4	2050	6M	R	60[14]	1800	GE	0.5	5	H	47.5	1	RB	2450	240
22.6	281.6	Re	M[18]	V	M[26]	V	P	C	11.4	2100	6M, 1T	R	75[14]	1800	GE	0.5	5	H	60	1	RB	4412	340
14.0	.....	Re	M	Hy	M	Hy	P	C	12.2	2320	3M	R	50	3600	WE	0.75	4	H	32.5	1	AnAd	1355	130
11.3	47.3	Re	M	Hy	M	Hy	P	C	12.2	2320	3M	R	62.5	3600	WE	0.75	5	H	.....	1	.....	1940	193
0	23.0	Re	M	V	M	D	O	O	18.0		2M		20	3600	GE	1.12	4	H	15	1	AlBr	435	35
0	33.3	Tu	Mp	V	Mp	V	O, G	O, G	950[23]		2M	R	22.5	3600	GE	1.0	3	H	20.4	2	AlBr	460	45
1.3	61.0	Re	M	Hy	M	Hy	P	C	12.0	2200	2M	R	22.5	3600	GE	1.0	3	H	20.4	2	Ad	230	22.5
1.3	61.0	Re	M	Hy	M	Hy	P	C	12.0	2200	2M	R	22.5	3600	GE	1.0	3	H	20.4	2	Ad	460	45
15.0	63.0	Re	M	Hy	M	Hy	P, G	C, G	12.0	2200	2M	R	60	3600	GE	1.0	4	H	47.0	2	Ad	2300	240
18.1	36.5	Re	M	Hy	M	Hy	P	C, G	12.0	2200	1M	R	40	3600	GE	1.0	4	H	31.3	2	Ad	1600	160
.....	121.6	Tu	M	D	M	D	G, O	G, O	1062[25]	.....	3M	R	60	3600	GE	1.75	4	H	65.0	2	AsCu	1040	106
.....	44.1	Re	M	D	M	D	G, O	G, O	1050[25]	.....	1M	R	18.75[14]	3600	GE	1.75	4	H	15.0	2	AsCu	440	48
0	81.3	Re	M	V	M	V	G, O	G, O	1080[25]	.....	1M, 1T	R	60[8]	3600	GE	0.75	4	H	50.0	1	AsCu	1400	116
0	30.0	Re	M	V	M	V	G, O	G, O	1080[25]	.....													
0	104.7	Tu	M	D, V	M	D, V	G, O	G, O	1080[25]	.....	2M	R	60[8]	3600	WE	1.25	4	H	55.0	2	AsCu	1880	143
2.6	57.5	Tu	M	D, V	M	D	G, O	G, O	1018[25]	.....	1M, 1T		30[8]	3600	WE	1.25	4	H	30.0	2	AsCu	1350	93
18.8	83.5	Tu	M	D, V	M	D	G, O	G, O	1018[25]	.....	1M, 1T		60	3600	GE	1.75	4	H	65.0	2	AsCu	1625	174
18.8	83.5	Tu	M	D, V	M	D	G, O	G, O	1018[25]	.....	2M		60	3600	GE	1.75	4	H	65.5	2	AsCu	2450	234
0	56.1	Tu	M	V	M	D, V	G, O	G, O	1100[25]	.....	1M, 1T	R	30[8]	3600	GE	0.75	4	H	25.0	2	AsCu	940	76
0	20.3	Re	M	V	M	V, D	G, O	G, O	1100[25]	.....	1M, 1T	R	12.7	3600	EI	0.75	3	A	11.0	2	AsCu	1090	88
0	104.7	Tu	M[18]	D, V	M[18]	D, V	G, O	G, O	1100[25]	.....	3M	R	60[8]	3600	WE	0.75	5	H	55.0	2	AsCu	1765	148
0	55.6	Re	M	D	M	D	G, O	G, O	1072[25]	.....	3M	R	60[8]	3600	GE	1.25	4	H	50	2	Ad	2340	161
0	61.6	Tu	M	V	M	Ma	P	C	12.0	2400	2M	Hy	30[8]	3600	WE	0.75	4	H	27.5	2	PAd	775	65
0	38.6	Tu	M	V	M	V	G	G	.....	.....	1M, 1T	R	20	3600	GE	1.0	4	H	18.5	1	AsCu	500	40
0	53.3	Tu	M[29]	V	.....	.....	G, O	G, O	.....	.....	1M	R	30[8]	3600	WE	0.75	4	H	25.0	1	AsCu	600	60
0	53.3	Tu	M[18]	CP	.....	.....	G	G	1060[23]	.....	1M, 1T		30[8]	3600	GE	0.75	4	H	30.0	2	AAd	330	30

T —Turbine drive
TG —Traveling-grate stoker
Tu —Tubular
UF —Underfeed stoker
UI —Union Iron Works
V —Vane control
Vo —Henry Vogt Machine Co
W —Wood
WB —Wm Bros Boiler & Mfg Co
WE —Westinghouse Electric Corp
Wo —Worthington Pump & Machy Corp
(306) —Sq ft stoker area

1—Reheat to 1000 F
2—H-p shaft 3600, l-p 1800 rpm
3—Reheater 30,200 sq ft
4—Condenser is turbine foundation
6—400 to 275 psig
7—Ranging up to 13,900 Btu per lb
8—75,000-kw capability
9—AIEE-ASME preferred standard
10—Reheater 9000 sq ft
11—Reheat to 950 F
12—30,350 on oil, 32,300 on gas
13—Gas, 1009 Btu per cu ft
15—18,300 on oil, 19,400 on gas
16—2 units being installed
18—3 house units being installed
19—3 units being installed
20—Reheat to 750 F
21—2nd unit starts 6-51
23—Reheater 10,500 sq ft
25—2 fans per unit
26—70% bituminous, 30% anthracite
27—Anthracite 12,500 Btu per lb
28—2nd unit starts 6-50
29—2 motor-driven fans
30—Btu per cu ft
31—2-speed motor
32—Also pitch
33—Second unit in 10-51
34—F-d fan only, furnace designed for pressure operation
35—Drives controllable-pitch blower for pressurized furnace
36—Revised, originally listed in 1948 survey
37—Second-hand unit
38—17,000 on coal, 27,000 on wood
39—Automatic-extraction unit

1949 Listing of Typical Central-Station

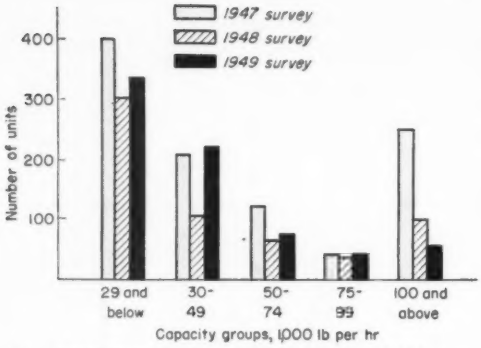
For notes on uses and limitations of this tabulation ● See page 96

Compiled by B G A Skrotzki, Associate Editor

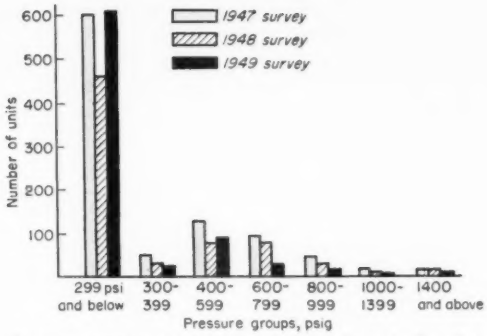
Company	Location	Plant Name	Consulting Engineers	First Operation, New Units	Nominal Pressure, psi	Nominal Steam Temperature, F	BOILERS: Number	Capacity, each 1000 lb per hr	Manufacturer	Boiler, Waterwall Surface, 1000 sq ft	Superheater Surface, 1000 sq ft	Furnace Volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace Bottom
Public Service Co of Indiana	Edwardsport, Ind	Edwardsport	Sargent & Lundy	1-49	850	900	2	400	RS	34.4	14.1	29.0	17.6	DB
Savannah Electric & Power Co	Savannah, Ga	Riverside	Stone & Webster	1-50	850	900	1	200	CE	7.1	7.6	9.3	28.2	DB
Tampa Electric Co	Tampa, Fla	Hookers Point	Stone & Webster	7-48	850	900	2	200	BW	14.5	5.0	8.7	32.0	DB
Central Illinois Electric & Gas Co	Rockford, Ill	Sabrooke	Stone & Webster	11-49	850	900	1	205	FW	22.3	4.4	10.5	26.2	
Western Massachusetts Elec Co	West Springfield, Mass	West Springfield	Stone & Webster	9-49	850	900	1	400	CE	15.6	1.9	29.2	17.3	DB
Virginia Electric Power Co	nr Dumfries, Va	Possum Point	Stone & Webster	1951	850	900	1	650	CE	43.0	.....	45.5	16.9	DB
West Penn Power Co	Milesburg, Pa	Milesburg	Sanderson & Porter	7-50	850	900	2	210	RS	22.6	.....	15.5	17.9	DB
The United Illuminating Co	New Haven, Conn	English	Westcott & Mapes	11-49	850	900	1	320	BW	.....	15.2	22.7	16.9	DB
Indianapolis Power & Light Co	Martinsville, Ind	White River	Gibbs & Hill	12-51	850	900	1	400	CE	25.5	13.8	23.2	22.5	ST
South Carolina Power Co	Charleston, S C	Hagood	Gilbert Associates	5-50	850	900	1	230	RS	19.6	7.4	13.4	21.6	DB
				6-51	850	900	1	310	RS	24.9	10.0	.....	21.6	DB
Philadelphia Electric Co	W Norriton Town, Pa	Barbadoes		2-49	850	900	2	600	FW	30.5	20.8	47.1	15.4	DB
Duquesne Light Co	South Heights, Pa	Frank R Phillips		1949	850	900	1	600	FW	23.9	17.1	35.0	20.9	DB
				1950	850	900	2	600	FW	23.9	17.1	35.0	20.9	DB
West Texas Utilities Co	Ouahuah, Texas	Lake Pauline	Sargent & Lundy	3-51	850	900	1	250	BW	15.8	6.3	10.6	30.8	DB
	Amherst, Texas	Plant "X"		2-52	850	900	1	500	CE	34.5	.....	22.2	29.0	DB
Southwestern Public Service Co	Amarillo, Texas	East[31]		3-51	650	825	1	400	BW	32.2	9.8	17.8	29.7	DB
	Roswell, N M	Roswell	Stearns-Roger Mfg Co	7-50	650	825	1	210	BW	15.8	3.6	9.0	29.7	DB
	Abernathy, Texas	Tuco[31]	Stearns-Roger Mfg Co	7-49	600	825	1	275	BW	18.3	5.3	11.2	32.0	DB
	Springfield, Ohio	Mad River	Commonw & Southern	1-49	850	900	1	250	RS	18.0	6.2	15.0	23.0	DB
Ohio Edison Co	Toronto, Ohio	Toronto	Commonw & Southern	9-49	800	875	1	600	BW	11.4	16.5	44.1	18.4	DB
				1-50	800	875	1	600	BW	11.4	16.5	44.1	18.4	DB
	Akron, Ohio	Gorge	Commonw & Southern	12-48	800	875	1	450	BW	17.1	17.9	30.9	19.1	DB
Oklahoma Gas & Electric Co	W. of Okla. City, Okla.	Mustang	Pioneer Serv & Engrg	3-50	850	900	1	475	BW	11.2	18.3	30.1	20.6	DB
				3-51	850	900	1	475	BW	11.2	18.3	30.1	20.6	DB
	Minneapolis, Minn	Riverside	Pioneer Serv & Engrg	7-49	850	900	1	570	BW	13.5	22.9	37.5	20.0	DB
	Sioux Falls, S D	J L Lawrence	Pioneer Serv & Engrg	9-48	650	825	1	125	BW	15.5	5.3	7.9	22.0	.....
Northern States Power Co	Mankato, Minn	G H Wilmarth	Pioneer Serv & Engrg	10-48	650	825	1	125	BW	15.5	5.3	7.9	22.0	.....
	St. Cloud, Minn	Whitney	Pioneer Serv & Engrg	6-48	450	750	1	125	Vo	10.8	2.4	5.5	33.0	.....
	La Crosse, Wis	French Island	Pioneer Serv & Engrg	4-48	450	750	1	125	EM	14.9	5.1	7.5	29.7	.....
	Grand Forks, N D	Grand Forks	Pioneer Serv & Engrg	9-48	400	750	1	65	WB	9.3	2.0	4.2	23.0	.....
Madison Gas & Electric Co	Madison, Wis	Blount	Mead & Hunt	11-48	825	825	1	200	BW	19.3	.....	.....	15.2	DB
600 PSIG TO 799 PSIG														
Pennsylvania Electric Co	Indiana County, Pa	Seward	Gilbert Associates	1950	650	825	2	300	BW	28.5	.....	19.3	19.3	DB
Holyoke Water Power Co	Holyoke, Mass	No. 1	Jackson & Moreland	10-48	650	750	.....	.....	.....	.....	.....	.....	.....	.....
Interstate Power Co	Sherburn, Minn	Fox Lake	Sargent & Lundy	9-50	600	900	2	120	RS	14.3	0.9	9.9	17.5	DB
Central Louisiana Electric Co	St. Landry, La	Coughlin	Sargent & Lundy	9-48	650	750	1	120	CE	.....	.....	.....	22.0	.....
Fitchburg Gas & Elec Light Co	Fitchburg, Mass	Sawyer Passway	Chas T Main, Inc	12-49	600	825	1	150	CE	18.7	.....	8.7	20.5	DB
Texas Electric Service Co	Wichita Falls, Texas	Wichita Falls	Ebasco Services, Inc	5-49	600	825	1	150	CE	12.0	3.2	6.1	33.1	DB
Dallas Power & Light Co	Dallas, Texas	Mountain Creek	Ebasco Services, Inc	3-50	600	825	2	150	CE	.....	.....	.....	33.1	.....
Imperial Irrigation District	El Centro, Calif	El Centro	Gibbs & Hill, Inc	4-49	600	825	1	260	CE	17.0	4.0	9.3	32.8	DB
Minnkota Power Cooperative, Inc	Grand Forks, N D	Grand Forks	Ellerbe & Co	11-49	600	825	2	72	RS	9.5	2.5	4.0	28.0	DB
Public Service Co of New Mexico	Albuquerque, N M	Prager	Stearns-Roger Mfg Co	12-48	615	825	1	125	BW	11.6	1.4	5.0	34.1	.....
The Tucson Gas, Elec Lt & Pwr Co	Tucson, Arizona	No. 3	Sanderson & Porter	1949	615	825	1	150	BW	13.3	3.3	5.6	.....	DB
Grand River Dam Authority	Pryor, Oklahoma	Chouteau	W R Holway & Assoc	11-49	600	750	.....	.....	.....	.....	.....	.....	.....	.....
New Hampshire Gas & Electric Co	Portsmouth, N H	Portsmouth	Gilbert Associates, Inc	6-50	600	825	1	100	CE	12.4	.....	6.0	23.7	DB
UNDER 600 PSIG														
Omaha Public Power District	Omaha, Neb	South Omaha		6-48	450	750	1	200	CE	14.5	.....	7.9	.....	.....
Central Ohio Light & Power Co	Bluffton, Ohio	Woodcock	Sargent & Lundy	12-47	425	835	1	120	RS	14.0	3.1	8.0	20.0	DB
				6-50	425	835	1	120	RS	14.0	3.1	8.0	20.0	DB
Iowa-Illinois Gas & Electric Co	Coralville, Iowa	Coralville	United Lt & Rwy Serv	8-49	425	740	1	60	RS	8.9	0.7	3.2	26.8	DB
Public Service Co of New Mexico	Santa Fe, N M	Santa Fe	Stearns-Roger Mfg Co	11-49	415	750	2	50	CE	2.4	0.3	0.3	.....	.....
Georgia Power & Light Co	Wayeross, Ga	Wayeross	Gibbs & Hill	11-48	410	725	3	44.5	CE	2.4	0.3	0.3	.....	DB
Missouri Public Service Corp	Sedalia, Mo	Sedalia	Burns & McDonnell	11-49	400	750	1	90	BW	12.0	.....	5.0	29.0	.....
Public Service Co of Colorado	Grand Junction, Colo	Grand Junction		4-48	400	750	1	60	BW	9.8	1.5	6.2	13.6	ST
			Stone & Webster	1-50	400	750	1	85	RS	10.3	0.8	4.6	25.0	DB
Wellsboro Electric Co	Wellsboro, Pa	Wellsboro	Zack C Hinds	7-47	400	650	2	36	K	4.0	.....	1.3	39.6	.....
	Beulah, N D	Beulah	Stearns-Roger Mfg Co	11-49	400	750	2	50	BW	6.1	.....	2.7	28.2	.....
Montana-Dakota Utilities Co	Bismarck, N D	Bismarck	C M Garland & Co	6-48	175	450	1	60	RS	8.1	1.3	2.6	37.0	.....
	Kincaid, N D	Kincaid	Stearns-Roger Mfg Co	11-48	200	520	1	60	BW	8.2	.....	3.3	27.0	.....
Public Service Co of Oklahoma	Lawton, Okla	Lawton		7-48	300	600	1	200	BW	18.4	.....	9.0	30.5	DB
New York Steam Corp	New York, N Y	60th Street	Baker & Spencer Inc	1-48	300	Sat	1	300	BW	35.7	0	17.1	21.9	.....
The Connecticut Power Co	Stamford, Conn	Stamford	Stone & Webster	1-49	190	500	2	125	BW	11.9	0.5	5.8	28.9	.....
Hope Natural Gas Co	Hastings, W Va	Hastings	Dravo Corp	1948	175	500	.....	.....	.....	.....	.....	.....	.....	.....
MUNICIPAL PLANTS														
Board of Public Utilities	Kansas City, Kan		Burns & McDonnell	1951	850	900	1	300	BW	18.3	.....	20.0	21.4	ST
Electric Department	Austin, Texas		Burns & McDonnell	6-50	850	900	1	200	CE	21.2	6.3	11.3	24.3	.....
				6-51	850	900	1	200	CE	21.2	6.3	11.3	24.3	.....
City of Springfield	Springfield, Ill	Lakeside	Burns & McDonnell	7-49	700	875	1	250	SP	12.1	7.7	14.0	24.2	DB
City of Cleveland	Cleveland, Ohio	Lakeside	Burns & McDonnell	1951	650	825	2	300	FW	24.0	.....	14.5	31.0	ST
City Electric Dept	Rochester, Minn	Silver Lake	Sargent & Lundy	6-49	600	825	1	90	RS	13.2	2.2	.....	.....	DB
Eugene Water & Electric Board	Eugene, Oregon	Steam		10-49	600	825	1	175	RS	28.7	3.6	13.0	17.0[31]	.....
City of Ames	Ames, Iowa		Burns & McDonnell	7-50	600	825	1	95	RS	13.9	.....	5.8	24.3	.....
City of Henderson	Henderson, Ky		Burns & McDonnell	7-51	600	825	2	60	BW	12.7	.....	3.4	24.4	.....
Municipal Electric Light Plant	Hagerstown, Md		Albert C Wood	9-49	460	730	2	70	EC	8.3	.....	2.6	35.0	.....
Columbia City	Columbia, Ind	Light		.....	450	750	1	60	EM	.....	.....	.....	.....	.....
Municipal Power & Light	Trinidad, Colo		Rocky Mountain Co	1-50	450	750	2	55	CE	.....	.....	.....	25.0	.....
City of Coleman	Coleman, Texas		Terrell Bartlett Engr	9-49	450	750	1	28	BW	.....	.....	.....	.....	.....
Municipal Power & Light	Pella, Iowa		Brown Engrg Co	4-48	450	750	1	25	BW	4.3	1.1	1.4	25.4	.....
Municipal Utilities	Owensboro, Ky		Black & Veatch	.....	425	750	2	100	BW	.....	.....	.....	.....	DB
City of Alliance	Alliance, Neb		Black & Veatch	7-49	425	750	1	30	MI	5.8	1.2	2.1	25.0	.....
Valley City	Valley City, N D			11-49	400	700	1	60	EC	6.7	.....	2.4	37.0	.....
Board of Public Works	Hannibal, Mo	Hannibal	Black & Veatch	5-50	400	850	1	100	MI	11.8	3.5	.....	.....	.....
Salt Riv Valley Water Users Assn	Tempe, Ariz	Cross Cut	C C Moore & Co	6-49	400	750	3	37.5	BW	5.7	1.0	0.6	.....	.....
Municipal Public Utilities	Owatonna, Minn		Pfeifer & Shultz	1950	400	750	.....	.....	.....	.....	.....	.....	.....	.....
Department of Utilities	Schuyler, Nebr		Black & Veatch	.....	400	750	1	23	MI	2.9	0.4	.....	.....	.....
City Utilities	Fort Wayne, Ind	Lawton Park		.....	400	700	.....	.....	.....	.....	.....	.....	.....	.....
Municipal Utilities	Marshall, Mo		Black & Veatch	5-48	400	725	1	54	CE	8.3	1.4	3.6	.....	.....
Municipal Utilities	Madison, Minn		Perkin & McWayne	5-49	400	700	2	35	EM	6.5	.....	.....	.....	.....
Borough of Etna	Etna, Pa		Joseph Breslove	9-49	400	700	1	40	UI	5.0	.....	.....	.....	.....
Municipal Light Plant	Quakertown, Pa		Gilbert Associates, Inc	3-48	345	550	1	40	CE	5.1	.....	.....	29.5	.....
City of Hamilton	Hamilton, Ohio		Emery, Markent, Emery	9-49	330	630	1	125	BW	.....	.....	.....	.....	.....
Municipal Power & Water	Metropolis, Ill		Rogers Schmidt	.....	315	720	1	40	RS	.....	.....	.....	.....	.....
Water & Light Dept	Clarksdale, Miss		Black & Veatch	6-49	300	550	1	70	CE	9.0	1.9	.....	26.7	.....
Public Utilities Commission	Redwood Falls, Minn		G M Orr Engrg Co	.....	250	550	2	25	UI	3.5	.....	.....	.....	.....
Light & Water Utility	Richland Center, Wis		Ralph D Thomas	4-48	225	500	1	50	BW	.....	.....	.....	.....	.....
Municipal Water & Light	Hope, Ark		F W Rabe	4-49	200	360	.....	.....	.....	.....	.....	.....	.....	.....
City of McLeansboro	McLeansboro, Ill		S J Sibley & Assoc	.....	475	750	1	20	B W	.....	.....	.....	.....	.....

and Municipal Power-Plant Installations

Economizer Surface per Boiler, 1000 sq ft	Air-Heater Surface per Boiler, 1000 sq ft	Air-Heater Type	F-D FANS		I-D FANS		FUEL				FEED PUMPS		TURBINES					Generator Cooling	CONDENSERS			Total Boiler Capacity Incl New Units, 1000 lb	Total Generator Capacity Incl New Units, 1000 kw
			Drive	Air-Volume Control	Drive	Gas-Volume Control	Firing	Type	Heating Value, 1000 Btu per lb	Ash-Fusion Temperature, F	Drive	Flow Control	Capacity, 1000 kw	Speed, rpm	Manufacturer	Back-pressure, psia	No. of Bleed Points		Surface, 1000 sq ft	No. Water Passes	Tube Material		
0	140.8	Re	M	D, Hy	M	D, Hy	P	C	11.0	2100	3M	.....	37.5	3600	GE	0.75	4	H	32.5	2	Ad	1720	1) 7.5
0	27.7	Re	M	D, V	M	Dm V	O	O	18.4	.....	3M	R	20[8]	3600	WE	1.0	4	H	16	2	AAd	680	56
0	.....	Re	M	V	M	D	O	O	18.0	.....	2M, 1T	R	30[8]	3600	WE	0.75	4	H	30	2	AlB	400	30
10.8	18.0	Tu	M	V	M	D, S	SS(426)	C	10.6	1950	2M	R	20[8]	3600	AC	0.75	4	H	16.5	2	Ad	205	20
13.3	94.4	Re	M	D, Hy	M	D, Hy	P	C	12.5[6]	2000	2M, 1T	R	40	3600	GE	0.75	4	H	35.0	2	Ad	400	45
18.2	98.6	Re	M[16]	.....	M[16]	.....	P	C	13.0	2300	3M	R	60[8]	3600	GE	0.75	5	H	50	2	Ad	1300	120
0	42.0	Tu	M	V	M	D	P	C	13.0	2300	3M	.....	20[8,14]	3600	WE	.....	4	H	13	2	Ad	420	40
7.1	82.6	Re	Mp	V	Mp	V	P, O	C, O	13.7	2800	2M, 1T	.....	30[8]	3600	GE	0.75	5	H	27.5	1	A1Br	1280	105
0	69.7	Re	Mp	V	Mp	V	P	C	11.0	1950	2M, 1MT	R	40[8]	3600	GE	0.75	4	H	30	2	AAd	1200	120
0	31.2	Re	Mp	V	Mp	V	O	O	.....	.....	2M	R	22.5	3600	WE	1.0	3	H	20.4	2	A1Br	460	45
0	45.2	Re	.....	.....	.....	.....	O	O	.....	.....	2M	R	30[8]	3600	WE	1.0	4	H	.....	2	A1Br	770	75
19.0	146.3	Re	M	V	M	Hy	P, O	C, O	13.3	2000	4M	.....	60[8,14]	3600	WE	0.75	5	H	37.5	2	Ad	1760	180
13.8	161.6	Re	M	V	M	D	P	C	12.0	2100	1M, 1T	S, R	65	3600	WE	0.75	5	H	50	1	Ad	1600	125
13.8	161.6	Re	M	V	M	D	P	C	12.0	2100	1M	S, R	65	3600	WE	0.75	5	H	50	1	Ad	2800	190
0	34.1	Tu	M[19]	CP	.....	.....	G, O	G, O	1080[25]	.....	1M, 1T	R	20	3900	GE	0.75	4	H	18.0	1	AsCu	550	35
0	.....	Re	.....	.....	M	D	G, O	G, O	.....	.....	2M, 1T	R	40[8]	3600	GE	1.75	4	H	42.5	2	AAd	500	40
0	45.7	Re	M	V	M	V	G, O	G, O	957[25]	.....	3M	R	30	3600	GE	1.75	4	H	37.5	2	AAd	975	65
0	17.9	Re	M	V	M	D, V	G, O	G, O	1000[25]	.....	2M	R	15[8]	3600	GE	1.75	4	H	20.0	2	AAd	500	26
0	.....	Re	M	V	M	V	G, O	G, O	.....	.....	.....	.....	20[8]	3600	GE	1.75	4	H	22.5	2	AAd	370	35
5.0	43.0	Tu	M	Hy	M	Hy	P	C	11.0	2200	2M	R	20[8]	3600	GE	0.5	4	H	18.2	2	Ad	780	60
22.3	151.0	Tu	Mp	D	Mp	D	P	C	11.0	2200	2M	R	60[8]	3600	WE	0.75	4	H	45.0	2	Ae	3150	235
22.3	151.0	Tu	Mp	D	Mp	D	P	C	11.0	2200	2M	R	60[8]	3600	WE	0.75	4	H	45.0	2	Ad	3750	295
17.2	85.6	Tu	Mp	V	Mp	D	P	C	11.0	2200	2M	R	35	3600	WE	0.5	.....	H	32.5	2	AnAd	1746	137
9.6	104.0	Re	M	Hy	M	ny	G, P	G, C	1100[25]	2000	2M	.....	50	3600	WE	1.25	5	H	45	2	Ad	475	50
9.6	104.0	Re	M	Hy	M	Hy	G, P	G, C	1100[25]	2000	2M	.....	50	3600	GE	1.25	5	H	45	2	Ad	950	100
10.3	141.6	Re	M[16]	Ma	M[16]	Ma	P, G	C, G	10.4	1900	2M, 1T	.....	50	3600	GE	0.75	4	H	45	2	PAD	3120	192
5.3	0	.....	M	V	M	Ma	TG-SS(306)	C	10.4	1990	1M, 1T	.....	12.5	3600	AC	0.5	4	A	11.0	2	PAD	125	12.5
5.3	0	.....	M	V	M	Ma	TG-SS(306)	C	10.4	1990	1M, 1T	.....	12.5	3600	AC	0.5	4	A	9.5	2	PAD	125	12.5
5.2	0	.....	M	V	M	D	UF-(230)	C	13.8	2500	1M	.....	12.5	3600	WE	0.5	4	A	9.5	2	PAD	225	20
5.1	0	.....	M	D	M	D	SS	C	10.4	1930	1M	.....	12.5	3600	AC	0.5	4	A	7.5	1	PAD	275	22.5
0	5.8	Tu	M	V	M	D	TG-SS(230)	L	6.6	2043	1M, 1T	R	5.0	3600	WE	0.75	3	A	5.0	2	Ad	202	13
0	79.7	Re	M	V	M	Hy	P	C	11.0	2000	1M	R	20[8]	3600	WE	0.75	4	H	12.5	1	PB	950	70
0	42.0	Tu	M	V	Mp	V	P	C	12.0	2295	2M	R	46	3600	WE	0.75	4	H	37.5	2	.....	1802	129
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	3600	GE	0.75	3	H	16.5	2	Mu	.....	42.5
0	21.7	Tu	M	V	M	Ma	P	G, G	10.5	1950	1M, 1T	.....	10	3600	WE	0.5	4	A	10.0	2	AdI	240	12.5
0	.....	Tu	M	D	M	D	G	G	1164[23]	.....	1M	R	10	3600	GE	0.75	3	A	10.0	2	Ad	300	25
0	34.6	Re	M	V	M	D	P, O	C, O	13.8	2100	1M,IT,1MT	.....	10	3600	GE	1.0	4	A	10.0	2	AB	463	32
0	20.3	P1	M	D	M	D	G, O	G, O	1050[25]	.....	1M, 1T	R	11.5[8]	3600	E1	1.75	4	A	11.0	2	AsCu	526	35.9
0	.....	Re	M	D	M	D	G, O	G, O	1080[25]	.....	2M	R	11.5[8,14]	3600	E1	1.0	3	A	11.0	2	AsCu	1700	141
0	31.9	Re	Mp	V	Mp	D	G, O	G, O	1050[25]	.....	2M, 1T	.....	20	3600	WE	1.0	3	H	20.0	2	Ad	260	20
2.1	8.6	Tu	M	V	M	S	TG-SS(196)	L, O	7.0	2200	2M, 1T	R	5	3600	DL	0.75	2	A	6.8	2	Ad	144	23
0	15.9	Tu	M	V	M	D	G	G	1060[25]	.....	2M	R	11.5[8]	3600	GE	0.75	4	A	12.0	2	Ad	423	38
0	12.7	Tu	M	Hy	M	D	G, O	G, O	1100[25]	.....	2M	R	12.5	3600	WE	1.0	3	A	4.1	4	Ad	150	12.5
0	12.7	Tu	M	Hy	M	D	G, O	G, O	1100[25]	.....	1M	R	11.5[8]	3600	WE	1.0	4	A	4.1	4	Ad	300	24.0
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	3600	GE	1.25	3	A	12.0	2	Ad	960	30
3.6	5.1	Tu	M	V	M	V	SS(241)	C, O	12.2	2100	1M	R	2.5[14]	3600	GE	0.75	1	A	.....	2	Ad	180	10
0	23.1	Re	M	D	M	D	G, O	G, O	1005[25]	.....	1M	R	15	3600	GE	1.0	2	H	14.0	2	AsCu	600	20
0	19.5	Tu	M	D	M	Hy	P	C	12.0	2300	2M	R	10	3600	WE	0.75	4	A	15.0	2	.....	330	27.5
0	19.5	Tu	M	D	M	Hy	P	C	12.0	2300	2M	R	10	3600	WE	0.75	4	A	15.0	2	.....	450	37.5
3.0	0	.....	M	V	M	D, Hy	TG-SS(168)	C, G	.....	2000	1M	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	120	9
0.9	.....	Tu	M	V	M	V	G	O	1060[23]	.....	2M	R	6	3600	GE	0.75	2	A	7.3	2	Ad	80	6
0.8	0	.....	T	S	.....	.....	O	O	18.5	.....	1M, 1T	R	4.25	3600	GE	0.75	0	A	3.8	2	CuNi	.....	.....
3.5	0	.....	M	V	M	S, D	G, O	G, O	1030[23]	.....	1M, 1T	R	7.5	3600	GE	1.0	3	A	10.0	2	AsCu	210	11.5
0	5.0	Tu	M	D	M	D	P	C	10.8	2800	2T	S, R	5.0	3600	WE	0.75	3	A	6.0	2	Ad	147	8.9
3.0	4.7	Tu	M	D	M	D	SS(221)	C	11.5	2100	2M, 1T	R	7.5	3600	GE	0.75	2	A	7.0	2	AdI	85	7.5
0	2.1	Tu	M	D	M	D	SS(88)	C	13.1	2350	2M, 1T	R, S	3.5	3600	Wo	1.0	2	A	4.8	2	Ad	72	5.9
0	4.9	Tu	M	.....	M	D	SS(135)	L	7.0	2200	2M, 1T	R	7.5	3600	GE	0.75	3	A	8.5	2	Ad	240	13.5
0	8.0	Tu	M	D	M	D	TG(212)	L	7.0	2200	1T	R	5.0[23]	3600	GE	1.0	2	A	8.3	2	A1Br	156	11.3
0	.....	Tu	T	D	T	D	TG-SS(163)	L	6.4	1900	1M, 1T	R	4.0[23]	3600	GE	1.0	0	A	8.3	2	CuNi	109	6
0	20.4	Tu	M	V	M	D, Hy	G, O	G, O	1002[23]	.....	1M, 1T	R	15	1800	GE	1.0	1	A	24.0	1	AnAd	510	30
0	0	.....	T	D	T	D	O	O	18.4	.....	2T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	300	0
0	0	.....	M	D, V	M	D, V	O	O	18.0	.....	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.5	3600	E1	2.0	1	A	.....	.....	.....	.....	.....
0	65.3	Re	M	S, V	M	Hy	P	C	11.8	1900	2M	R	30	3600	WE	.....	4	H	32.5	2	.....	1050	100
0	20.6	Tu	M	D, V	M	D, V	G	G	1000[23]	.....	3M	R	20[8]	3600	WE	0.75	4	H	17.0	2	Ad	640	44
0	20.6	Tu	M	D, V	M	D, V	G	G	1000[23]	.....	3M	R	20[8]	3600	WE	0.75	4	H	17.0	2	Ad	840	64
0	36.1	Re	M	Hy	M	Hy	P	C	10.0	1950	2M, 1T	.....	20	3600	AC	0.5	4	H	20.0	2	Mu	880	60
0	71.8	Re	M	S, V	Mp	D	P	C	12.0	.....	2M	R	25[14]	3600	BB	0.5	.....	A	23.0	2	Ad	1500	87.5
0	11.6	P1	M	Hy	M	Hy	P, G	C, G	11.8	.....	1M, 1T	R	7.5	3600	WE	0.5	4	A	8.0	2	AdI	340	20
0	27.5	Tu	T	D	T	D	SS(540)	C, W	12.0	1950	2M, 1T	R	11.5[8]	3600	WE	1.0	4	A	12.0	1	Ad	400	30
5.4	0	.....	M	Hy, D	M	Hy, D	TG-SS(272)	C, G	9.2	1950	1M, 1T	R	7.5	3600	GE	0.5	3	A	10.0	2	Ad	235	16.5
4.9	0	.....	M	V	M	S, D	TG-SS(135)	C	9.6	1900	3M, 1T	R	5.0[14]	3600	DL	0.5	3	A	6.0	2	.....	120	10
0	3.7	Tu	Mp	V	M	D	SS(136)	C	14.0	2400	1M	R	5	3600	Wo	.....	2	A	6.2	1	Ad	270	18
.....	.....	.....	M	.....	M	.....	SS	C	11.6	.....	1M	.....	3.5	3600	WE	.....	.....	.....	6.0	.....	.....	100	7
.....	.....	.....	M	.....	M	.....	SS	C	13.0	.....	2M, 1T	R	3.0	3600	WE	.....	2	A	.....	.....	.....	110	6
0	.....	.....	.....	.....	M	D	G	G	1000[23]	.....	2T	R	1.0	3600	WE	1.5	1	A	1.3	2	Ad	46	1.8
1.7	0	.....	M	V, Hy	M	Hy	TG-SS(67)	C	9.4	1850	1M, 1T	R	1.5	3600	E1	.....	2	A	2.0	2	Ad	.....	3.3
0	0	.....	Mp	D	Mp	D	P	C	10.0	2000	3M, 1T	R	7.5	3600	WE	.....	2	A	10.0	2	.....	300	22.5
3.6	0	.....	M	V	Mp	D	SS(124)	L	9.3	.....	2M, 1T	.....	5	3600	GE	0.75	3	A	5.5	2	Ad	107	9
0	5.2	Tu	T	D	M	D	TG-SS(150)	L	6.8	.....	3T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	185	5
3.5	0	.....	M	S, D	M	Hy	SS	C	11.0	.....	1M, 1T	R	10	3600	WE	.....	3	A	14.0	2	Ad	240	23.5
1.4	0	.....	T	S	.....	.....	G, O	G, O	1100[23]	.....	1M	.....	7.5	3600	GE	1.0	2	A	9.0	2	AsCu	413	30
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.0	3600	WE	.....	.....	A	6.0	2	.....	.....	8.5
1.4	0	.....	.....	.....	Mp	D	G	G	1000[23]	.....	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	36.7	2.3
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1M, 1T	R	10	3600	GE	1.0	4	A	11.0	2	Ad	.....	47.5
.....	5.5	Tu	M	D	Mp	D	G, O	G, O	1050[23]	.....	1M, 1T	R	4	3600	E1	1.0	3	A	7.0	.....	.....	118	8
0	0	.....	M	V	.....	.....	UF	C	12.2	2250	1M, 1T	R	1.5	3600	WE	2.5	2	A	2.5	2	.....	65	2.8
0	0	.....	T	V	M	S, D	TG(140)	C	13.0	2200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.6
0	0	.....	M	D	T	S, D	SS(112)	C	12.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	80	4.5
.....	.....	Tu	MT	.....	MT	D, V	UF	C	13.0	2900	3M, 1T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	470	23.5
.....	.....	.....	.....	.....	.....	.....	TG	C	12.0	.....	1M, 1T	.....	2.0	3600	WE	.....	.....	.....	.....	.....	.....	66	3.5
0	7.6	Tu	M	.....	Mp	D	G, O	G, O	960[23]	.....	1M, 1T	R	3.5	3600	WE	1.0	1	A	4.0	2	Ad	160	7.5
0	0	.....	M	D	.....	.....	SS(90)	C	.....	.....	.....	.....	2.0	3600	WE	2.5	0	A	3.5	2	Ad	50	3.7
.....	0	.....	M	V	T	S	TG-SS	C	12.5	.....	1T	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	110	3.2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.5	3600	WE	1.25	2	.....	.....	.....	.....	85	4
0	0	.....	M	.....	.....	.....	TG(140)	C	.....	.....	.....	.....	1.25	3600	GE	5	1	A	.....	1	.....	.....	1.9

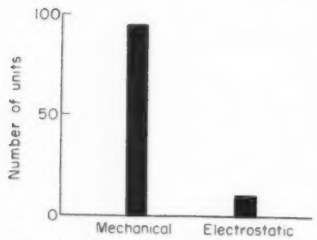


1 Smaller boilers lead in number of units but 50,000-lb-per-hr and over boilers almost match all the rest in capacity



2 Large number of low-pressure boilers reflects the fact that most industrial plants need steam for heating and process

Modernization and Additions to Plant



5 Mechanical dust collectors lead in number of industrial installations

Summaries show what's going on with respect to pressure levels, unit sizes, methods of firing, fuels, application of dust collectors, etc. For details of individual industrial installations, turn to tabulated technical data on following pages

► Technical details of roughly 300 industrial installations appear in the tables on the following pages. This compares with estimated sales of power boilers to industry of something over 700 units. Information in the tables tends to bear out an earlier report* that industry's spending in 1948-49 would be largely for modernization rather than new plants. The overwhelming majority of reported equipment answers this description.

At the time of last year's survey (Oct. pp 71-132), the pulp-and-paper industry, chemical plants and oil refineries, plus the steel mills, were engaged in rapid expansion of facilities. This year no single segment of the economy is pushing an equivalent program. But total amount of new steam and power generating equipment going into service remains at a healthy level.

Steam Trends. Fig. 1 and 2 show how new equipment on which data are available groups itself according to size of boiler units and pressure level. The same general spread in capacity groups which has been evident in past years repeats itself. Both 1947 and 1948 figures are shown for comparison.

When number of units is considered rather than steaming capacity, the small sizes dominate, as might be expected. Yet steaming capacity of units 50,000 lb per hr and over comes very close to equalling the total capacity of all smaller units. This excludes, of course, the many hundreds of smaller heating boilers, which these POWER surveys do not attempt to cover.

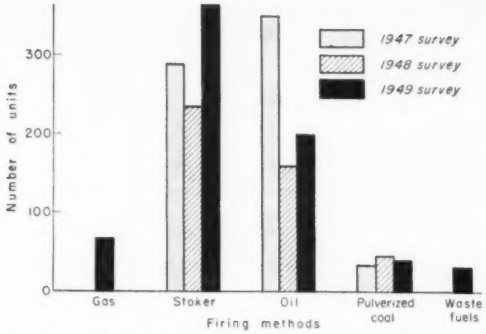
When it comes to pressure, the largest single group is in the low-pressure range, but the total number of installations employing units of 300 psi or over is impressive. In the group below 299 psi, it is likely that process and heating steam form the major demand, with only occasional exceptions. Although some processes require higher pressures than 299 psi, it is reasonable to assume that in most of the installations above 299 psi, steam for power generation and plant-service equipment such as pumps and compressors, forms a major consideration in establishing the pressure level.

In the higher pressure group where power generation tends to influence pressure level, the largest group centers around 450 psi, but there are an impressive number of plants operating at considerably higher pressures. This undoubtedly reflects the postwar tendency for the plant electrical demand to outstrip process-steam demand in rate of growth. It serves to add confirmation to a number of recent studies predicting rapid expansion of industrial use of electricity.

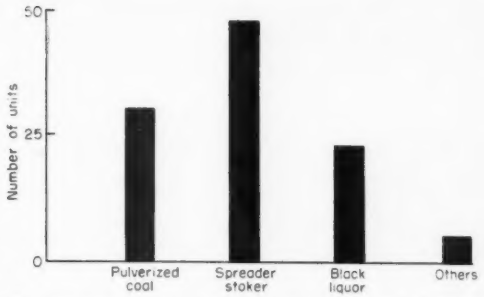
These studies point out the ever-increasing demand for electricity represented by more intensive use of labor-saving machinery, wider application of high-level lighting and industrial air conditioning, and similar well established practices. They also stress the introduction of new industrial processes demanding electricity—induction heating, infra-red drying, ore beneficiation, etc.

Fuels and Firing. Fig. 3 shows methods of firing in installations on which data were available. In last year's survey, a slight increase in coal-burning equipment, particularly stokers, seemed evident. At that time oil supply was still tight and prices comparatively high. Since then production of oil has caught up with demand, and prices

**Business Needs for New Plant and Equipment*, Dept. of Economics, McGraw-Hill Publishing Co. Inc



3 Comparison of fuels and firing methods shows stoker firing of coal still in the lead, with gas growing in importance



4 Growing use of dust collectors reflects emphasis on pollution control. Chart shows units reported by type of firing

Characterize Industrial Activities

(particularly of heavy oils) have dropped (See POWER, July 1949, pp 100-101). It is still too early to see what effect this will have on firing equipment selected for new plants and modernizations. Plants covered in this survey were in the planning or later stages before the fuel situation changed abruptly late last winter. It should be noted that many of the pulverized-coal installations are also capable of burning oil, either immediately or with slight modifications.

Most noticeable is the relatively large number of gas-fired units reported. This reflects continued favorable price position of gas in large areas of the country. Many oil-fired installations are also equipped to fire gas.

Dust Control. The widespread drive to clean up atmospheric pollution both from within industry and by local enforcement shows itself in this year's survey, in which data on dust-collection equipment was obtained for the first time. Fig. 4 shows the number of dust collectors reported and the types of firing with which they are used. As might be expected in the industrial field, a large percentage of these units are used in connection with spreader stokers. On recovery boilers firing black liquor, dust collection contributes to recovery of chemicals.

Conditions in the industrial field prove generally favorable to various types of mechanical dust collectors, Fig 5. One factor is the larger percentage of small boilers. Another is the dominance of stoker firing, producing dusts of relatively large particle size rather than fine flyash.

TABLE I—PRESSURE DIVISIONS

	Stoker			Oil			Pulverized coal			Unreported or otherwise		
Pressure, psi	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949
299 and below	247	187	201	260	138	129	8	6	5	143	115	88
300-399	7	1	6	14	6	2	1	4	2	20	13	5
400-599	21	34	18	24	7	9	10	17	12	73	12-	21
600-799	6	4	7	27	8	4	24	22	7	34	35	11
800 and above	4	8	1	19	5	4	6	15	4	20	0	2

TABLE II—CAPACITY DIVISIONS

	Stoker			Oil			Pulverized coal			Unreported or otherwise		
Capacity M lb per hr	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949
29 and below	132	108	205	130	110	92	4	2	1	133	183	36
30-49	58	47	90	92	26	72	4	7	4	60	27	41
50-74	34	25	28	30	17	21	5	9	10	55	10	18
75-100	4	18	13	11	0	11	2	14	4	28	8	9
Above 100	24	21	13	91	13	12	31	38	21	14	26	15

Three-Year Figures. A summary of totals for the years 1947, '48 and '49 makes up Tables I and II. They break down reported over-all figures by pressure and capacity for each of the principal firing methods.

Table II is of particular interest. Adding the figures under each of the major fuel-burning methods gives distribution capacity-wise for the last three years. Of a total of 810 units reporting stoker installations of one kind or another, 445 are on boilers with a steaming capacity of 29,000 lb per hr, or less. The next largest group is in the range between 30,000 and 49,000 lb per hr—195 stokers.

In the 728 reported oil-burning installations, the largest group is again in the 29,000-lb-per-hr-and-below range, 332 units. Likewise, the next largest group—198 units—appears in the 30,000 to 49,000-lb-per-hr bracket. But next in frequency of selection comes the units of 100,000 lb per hr and over. In this size range there are 116 oil-fired units, more than the combined total in the intervening size ranges.

As might be expected, frequency of application of pulverized-coal firing increases with size of boiler unit. Only 7 pulverized-coal units appear in the range below 30,000 lb per hr; there are 90 at 100,000 lb per hr and above.

Note that summaries, tables and bar charts on these pages come from data assembled from various sources and divided by calendar years. The tables on the following pages, as explained on p 96, do not include all current programs, nor do they consist entirely of current construction.

1949 Design Survey of Typical Industrial and

For notes on uses and limitations of this tabulation • See page 96

Compiled by J C McCabe, Associate Editor

Company	Location	Consulting Engineers	First Operation, New Units	Nominal Pressure, psi	Nominal Steam Temperature, F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Heating surface, 1000 sq ft	Furnace Volume, 1000 cu ft	Heat Release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer Surface per Boiler, 1000 sq ft
1400 PSI AND ABOVE													
Diamond Alkali Co	Painesville, Ohio	Gilbert Associates	12–48	1500	900	1	300	CE	15.4	26.0	17.5	DB	12.5
Union Bag & Paper Co	Savannah, Ga		.....	1425	950	1	520	BW	24.9	30.0	22.6	.....	17.1
900 TO 1399 PSI													
Carbide & Carbon Chemical Corp	Whiting, Ind	Day & Zimmerman	7–50	1000	740	3	165	RS	29.3	.....	.....	.....	14.3
Cornell University	Ithaca, N. Y	Gilbert Associates	10–49	975[6]	825	1	200	RS	42.2	.....	.....	DB	
Fort Howard Paper Co	Green Bay, Wis		4–49	925	825	1	150	BW	23.5	10.4	16.3	DB	9.9
Bethlehem Steel Co	Sparrows Point, Md		1949	900	900	2	400	.....	26.6	34.5	.....	.....	12.9
Diamond Alkali Co	Pasadena, Texas		7–48	900	900	4	100	CE	11.5	5.7	24.0	DB	0
Electric Metallurgical Div Union Carbide & Carbon Corp	Ashtabula, Ohio	Ford, Bacon & Davis	8–49	900	900	2	460	.....	49.3	63.2	17.8	DB	10.5
National Tube Co	McKeesport, Pa	Stone & Webster	12–49	900	750	5	175	CE	18.2	14.3	18.3	.....	0
600 TO 899 PSI													
Electro Metallurgical Div	Alloy, W. Va	Ford, Bacon & Davis	7–50	850	900	1	475	.....	13.6	31.6	18.0	DB	6.6
National Lead Co	St. Louis, Mo		6–49	850	750	2	75	BW	8.6	5.1	21.0	DB	
Bird & Son, Inc	East Walpole, Mass	Rust Engrg Co	2–50	710	750	1	175	RS	20.6	11.4	21.9	DB	0
Canadian Western Lumber Co	Fraser Mills, B. C	W O Stevens	11–49	675	725	3	75	CE	10.3	8.9	14.5	.....	
Morton Salt Co	Grand Saline, Texas	Cummins & Barnard	2–50	675	750	1	50	Wi	7.9	3.2	22.2	.....	0
Mueller Brass Co	Port Huron, Mich	Cummins & Barnard	12–49	675	750	1	110	EC	12.7	5.5	28.5	DB	9.8
Nanaimo Sulphate Pulp, Ltd	Nanaimo, B. C	H A Simons		675[6]	750	1	130	CE	20.5	.....	.....	ST	
Canadian Celanese, Ltd	Drummondville, Que	Atwood, Ltd	9–49	650	725	1	80	CE	10.3	3.9	28.6	DB	6.7
Columbia Cellulose, Ltd	Watson Island, B. C	Stadler-Hurter & Co	11–49	650	730	2	250	FW	25.5	15.2	21.8	DB	6.8
General Electric Co	Lynn, Mass	Stone & Webster	11–49	650	850	1	150	FW	20.7	8.9	22.1	DB	0
Johns-Manville Corp	Manville, N. J	Stone & Webster	12–49	650	650	1	100	BW	10.3	6.3	21.1	DB	
			6–50	650	650	1	100	BW	10.3	6.3	21.1	DB	
John A Roebling's Sons	Roebling, N. J	Rust Engrg Co	12–48	650	750	3	80	BW	10.3	4.4	25.0	DB	
Shell Oil Co, Inc	Wood River, Ill		2–48	650	750	1	175	BW	20.0	12.9	20.4	DB	0
Camp Mfg Co, Inc	Franklin, Va		7–49	625	750	1	140	BW	.....	.....	.....	.....	0
			3–50	625	750	1	154	BW	40.3	.....	.....	.....	6.5
General Electric Co	Erie, Pa		10–49	625	825	1	150	BW	16.8	7.9	27.9	.....	7.9
General Electric Co	Pittsfield, Mass		9–49	625	825	2	707	BW	3.5	13.4	14.8	DB	0
					1257	1	1000[7]	BW	13.2	.....	.....	.....	.....
Chas Pfizer & Co	Groton, Conn	Baker & Spencer, Inc	1–49	625	750	2	115	CE	13.2	6.1	22.5	DB	0
British Columbia Pulp & Paper	Port Alice, B. C	W O Stevens	12–49	620	725	1	210	CE	16.1	11.7	.....	.....	.....
American Boxboard Co	Filer City, Mich	Comm'l Testing & Engrg		615	750	1	125	BW	11.8	7.8	21.5	DB	
Arlington Div, Wm Whitman Co	Lawrence, Mass		5–49	600	740	1	125	BW	10.9	.....	.....	.....	5.3
British Columbia Pulp & Paper	Woodfibre, B. C	W O Stevens	7–48	600	725	1	100	BW	8.8	4.3	.....	.....	0
						2	100	BW	11.7	7.8	.....	.....	0
Celanese Corp of America	Rock Hill, S. C		9–48	600	750	3	150	RS	16.6	8.8	23.2	DB	0
Central Fibre Prod Co	Hutchinson, Kan	H M Wilson Co	1–50	600	650	1	100	CE	14.5	6.7	16.5	.....	0
Chillicothe Paper Co	Chillicothe, Ohio	W I Barrows & Assoc	5–48	600	750	1	80	RS	11.0	4.0	29.2	.....	2.5
Cit-Con Oil Corp	Lake Charles, La		6–49	600	650	3	150	CE	.....	.....	.....	.....	
Container Corp of Am	Wabash, Ind	Sargent & Lundy	6–49	600	750	1	75	BW	9.5	.....	.....	.....	4.2
Goodyear Tire & Rubber	Jackson, Mich		10–48	600	700	2	100	CE	.....	.....	.....	.....	.....
Hummel & Downing Co	Milwaukee, Wis	Sargent & Lundy	1949	600	725	1	75	BW	16.6	4.7	.....	DB	
Westminster Paper Co	New Westminster, B. C	W O Stevens	.....	600	725	1	45	FW	6.3	3.2	24.2	.....	0
Container Corp of Amer	Manayunk, Pa	H M Wilson Co	1–49	550	700	1	200	RS	21.6	13.1	20.8	DB	
E F Drew & Co	Boonton, N. J	Baker & Spencer, Inc	4–49	530	750	1	100	BW	9.3	4.5	30.4	DB	1.4
American Viscose Corp	Front Royal, Va			500	700	1	220	EM	23.6	13.2	.....	.....	
American Tobacco Co	Reidsville, N. C	Francisco & Jacobus	1948	475	650	2	100	BW	9.2	.....	.....	DB	0
Continental Can Co	Hopewell, Va			475	640	1	157	CE	.....	.....	.....	.....	.....
Lee Paper Co	Vicksburg, Mich			475	750	1	50	BW	6.6	.....	.....	.....	.....
American Crystal Sugar Co	Moorhead, Minn		9–48	450	550	2	90	BW	18.4	.....	.....	.....	.....
American Tobacco Co	Durham, N. C		1951	450	650	1	65	BW	7.6	.....	.....	.....	.....
						3	80	BW	8.6	3.2	33.8	.....	3.7
Appleton Coated Paper Co	Appleton, Wis	Pfeifer & Schultz		450	650	1	48	BW	6.2	2.1	30.0	.....	
Armstrong Cork Co	Beaver Falls, Pa		8–49	450	660	1	55	ke	8.4	2.0	40.0	.....	5.8
Carnegie Inst of Tech	Pittsburgh, Pa	Peter F Loftus		450	750	1	65	EM	10.9	2.9	29.1	.....	1.9
Chesapeake Paper Board	Baltimore, Md	F F Leilich	11–49	450	510	1	150	EC	17.9	6.5	28.8	.....	
John Morrell Co	Ottumwa, Iowa	Helmick, Edeskuty & Lutz	12–49	450	690	1	100	BW	10.4	9.2	.....	DB	
National Cash Register	Dayton, O		8–49	450	750	1	100	BW	10.0	4.3	.....	DB	
Newport Industries, Inc	Oakdale, La		3–48	450	560	2	75	BW	10.3	.....	.....	.....	
Ottawa Silica Co	Ottawa, Ill	Laramore & Douglass, Inc	12–49	450	690	.....	.....	.....	.....	.....	.....	.....	.....
Southern Adv Bag & Paper	Hodge, La		.....	450	600	1	63	CE	.....	.....	19.0	.....	.....
A E Staley Mfg Co	Decatur, Ill	Burns & McDonnell Eng Co	1950	450	750	.....	.....	.....	.....	.....	.....	.....	.....
Univ of Tennessee	Knoxville, Tenn	T C Thomasson	6–49	450[6]	500	1	100	CE	13.6	6.0	20.5	DB	0
Upson Co	Lockport, N. Y	Zack C Hinds	3–50	450	550	2	40	Wi	4.9	1.5	36.0	.....	0
Westelox Div, General Time Instr Corp	La Salle, Ill	Laramore & Douglass, Inc	12–49	450	750	1	35	RS	5.5	1.6	29.7	.....	0
Stanolind Oil & Gas Co	Elk Basin Field, Wyo	Stone & Webster	.....	440	650	1	55	CE	7.0	3.1	23.0	.....	0
						1	55	CE	7.0	3.1	23.0	.....	3.8
Jones & Laughlin Steel	Pittsburgh, Pa	Dravo Corp		430	725	1	220	CE	22.7	14.1	22.2	.....	.....
Commercial Solvents	Peoria, Ill	Sargent & Lundy	11–46	425	600	2	96	BW	9.1	3.6	.....	DB	
Farley & Loetscher Mfg Co	Dubuque, Iowa	Laramore & Douglass, Inc	3–49	425	750	1	45	BW	6.7	2.6	.....	.....	0
General Electric Co	Schenectady, N. Y		11–48	425	750	2	200	BW	17.1	15.7	16.6	DB	0
International Paper Co	Mobile, Ala		6–49	425	700	2	150	CE	16.4	7.0	33.8	DB	.....
International Paper Co	Panama City, Fla		6–49	425	700	2	154	BW	18.6	25.5	11.0	ST	5.8
						1	150	BW	13.7	6.1	37.0	.....	3.3
Merck & Co, Inc	Elkton, Va	Smith, Hinchman & Grylls	9–49	425	750	1	150	BW	14.4	6.6	31.0	DB	0
						1	75	EM	9.8	4.1	25.9	.....	3.8

A —Air cooled
AAd —Arsenical admiralty
AlBr —Aluminum-brass
AC —Allis-Chalmers Mfg Co
AsCu —Arsenical copper
Ad —Admiralty
Bi —Bigelow Co
BL —Black liquor
BW —Babcock & Wilcox Co
C —Coal, bituminous
CA —Coal, anthracite
CB —Cleaver-Brooks Co
CE —Combustion Engineering-Superheater Inc
Cu —Copper
CuNi —Copper nickel
CV —Canadian Vickers, Ltd
D —Damper
DB —Dry bottom
DBr —Dominion Bridge Co
DL —DeLaval Steam Turbine Co
Du —Duplex pump
E —Electrostatic
EC —Erie City Iron Works
El —Elliott Co
EM —Edge Moor Iron Works, Inc
FW —Foster Wheeler Corp
G —Gas
GE —General Electric Co
H —Hydrogen cooled
HF —Hogged fuel
Hy —Hydraulic coupling
Ke —E Keeler Co
M —Motor drive
Ma —Magnetic coupling
Me —Mechanical
Mp —Two motors per fan
MT —One motor, one turbine per fan
Mu —Muntz metal
O —Oil

Institutional Power Plants: 200 Psi or Above

Air-Heater Surface per Boiler, 1000 sq ft	Air-Heater Type	Dust Collectors	F-D FANS: Drive	F-D FANS: Air-Volume Control	I-D FANS: Drive	I-D FANS: Gas-Volume Control	Firing	FUEL: Type	FUEL: Heating Value, 1000 Btu per lb	FUEL: Ash-Fusion Temperature, F	FEED PUMPS: Drive	FEED PUMPS: Flow Control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of Bleed Points	Generator Cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. Water Passes	CONDENSERS: Tube Material	Total Boiler Capacity, Incl New Units, 1000 lb	Total Generator Capacity Incl New Units, 1000 kw
48.9	Re	Me	M	V	M	V	P	C	13.0	2150	2T	S	15.0	3600	GE	165	0	H	.....	.....	.....	1,500	50
78.6	Tu	.....	T	V	T	.....	O, G	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
34.8	Tu	Me	T	S	T	S	SS(918)	C	11.9	2155	3T	S	10.0	3600	GE	390	0	A	.....	.....	.....	495	10
.....	Tu	Me	MT	V	T	S	TG	CA	.....	.....	1M, 3T	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	200	.....
0	.....	.....	M	V	M	S	UF(446)	C	12.7	2550	1T, 1D[9]	S, R	2.5	3600	GE	400	0	A	.....	.....	.....	310	10
45.5	Tu	.....	.....	.....	.....	.....	TG[1]	O	.....	.....	.....	.....	30	3600	.....	0.8	.....	H	25.0	1	.....	.....	114
													30	3600	.....	0.8	.....	H					
18.7	Re	.....	M	V	M	V	G	G	.....	.....	3T	S	10.0	3600	GE	1.5	4	A					
													10.0	3600	GE	1.5	4	A	5.5	2	AAd	400	30
241.2	Re	Me	M	V	M	V	P	C	11.5	2000	2M, 1T	R	10.0	3600	GE	1.5	4	A					
													40.0	3600	.....	0.8	5	H	60	2	Ad	920	80
16.5	Tu	Me	T	S, D	T	S	P	C, G[2]	13.7	2000	1M, 2T	S	40.0	3600	.....	0.8	5	H	.....	.....	.....	1,275	13
120.0	Re	Me	M	V	M	V	P	C	11.3	2000	2T	R	40.0	1500	.....	0.8	5	H	30	1	Ad	1,450	125
16.5	Tu	Me	M	V	M	D	P	C, O, G	11.0	2160	2T	S	3.0	3600	DL	300	....	A	.....	.....	.....	308	12.5
23.0	Tu	Me	M	S, V	M	S, D	P	C	14.0	2100–2500	1M, 1T	S	5.0	3600	WE	60	1	A	.....	.....	.....	230	8.75
13.3	Tu	.....	M	V	M	D	.....	HF	.....	.....	2M, 2T	R	6.0	3600	GE	50	1	A	.....	.....	.....	300	12.5
6.5	Tu	.....	MT	D	MT	D	G	G	1060[3]	.....	1M, 1T	R	1.5	3600	WE	25	2	A	.....	.....	.....	60	1.5
.....	.....	Me	2Mp	V	2Mp	D	SS(191)	C	10.8	2036	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	170	0.5
.....	.....	E	M	V	M	Hy	O	O,BL,HF	.....	.....	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	300	.....
.....	.....	Me	M	V	M	D	SS(214)	C	13.3	2000	1M, 1T	R	2.5	3600	GE	100	1	A	.....	.....	.....	340	4.0
16.0	Tu	Me	MT	S, V	T	S, D	SS(540)	C[5]	11.3	2000	1M, 2T	R	7.5	3600	Wo	1.0	2	A	5.0	2	Ad	900	21.4
													7.5	3600	Wo	90	1	A					
17.9	Re	Me	M	D	M	D	P	C, O	12.3	.....	2M											300	.....
18.1	Tu	.....	T	S, D	T	S, D	P	C, O	13.9	2100	2M, 1T	R	5.0	3600	GE	.....	1	A	4.0	2	Ad	450	18.4
18.1	Tu	.....											5.0	3600	GE	.....	1	A					
20.6	Tu	Me	M	V	T	V	P	C	12.0	2000	2	R	5.0	3600	WE	.....	1	A	3.0	2	Ad	240	5.0
18.0	Tu	.....	T	.....	T	.....	P	O, C, G	11.0	1900	M, T	R	5.0	3600	GE	195	0	A	.....	.....	.....	1375	20.0
16.6	Tu	Me	M	D	M	S	P	C	.....	.....	2M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	774	13
.....	.....	E	M	D	M	V	.....	BL	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
0	.....	Me	M	V	M	S, D	SS(377)	C	12.6	2100	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	630	12.5
18.3	Tu	Me	M	V	M	S, D	P	C, O	14.1	2200	2M	.....	7.5	1200	GE	3.5	....	A	.....	.....	.....	400	24.0
11.8	Tu	Me	MT	V	MT	D	O, P	C, O	.....	.....	2T	R	2.5	3600	GE	.....	1	A	2.1	2	Ad	230	5.0
													2.5	3600	GE	65	....	A					
21.3	Tu	Me	M	V	M	D, Hy	O, P	O, HF	.....	.....	2M, 1T	R	3.5	3600	EI	50	....	A	.....	.....	.....	440	16.0
													3.5	3600	EI	150	....	A					
21.6	Tu	.....	M	V	M	D	P	C	11.1	2000	2T	S	5.0	3600	GE	0.75	2	A	4.5	2	Ad	285	8.0
.....	.....	Me	M	D	M	SS	.....	C	14.8	2420	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	450	20.0
14.2	Tu	Me	T	V	T	D	O	O	.....	.....	3T	R	2.0	3600	EI	65	1	A	2.0	2	.....	300	8.25
18.9	Tu	Me	T	V	T	D	O, HF	O	.....	.....	.....	.....	2.0	3600	WE	65	1	A					
													5.0	3600	WE	1.0	2	A	3.0	1	Ad		
17.7	Re	E	2M, 1T	V	2M, 1T	V	P	C, O	14.5	2400	1M, 1T	R	5.0	3600	WE	1.0	2	A	3.0	1	Ad	450	15.0
													5.0	3600	WE	65	1	A					
12.0	Tu	.....	M	V	T	S, D	G	G	1030[6]	.....	2T	S	2.5	3600	GE	1.0	1	A	2.0	2	Mu	180	3
0	.....	Me	M	V	M	D	SS(182)	C	13.5	2100	1M, 1T	S, R	4.0	3600	GE	0.75	1	A	3.5	2	Ad	140	7.5
20.3	Re	.....	.....	.....	.....	.....	.....	G	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	450	.....
0	.....	Me	M	D	M	D	TG	C	10.5	.....	1M, 1T	R	2.0	3600	GE	50	1	A	.....	.....	.....	75	4
													2.0	3600	GE	50	1	A					
	Tu	Me	T	D	T	D	P	C	.....	.....	1M, 2T	S, R	.....	.....	.....	.....	.....	.....	.....	.....	.....	315	.....
12.5	Tu	.....	T	D	T	.....	P	C	.....	.....	2T	.....	4.0	3600	AC	.....	1	A	.....	.....	.....	.....	4
7.0	Tu	Me	M	V	M	V	O	O, HF	.....	.....	1M, 1T	.....	0.9	4065	Wo	100	.....	A	.....	.....	.....	.....	.....
													1.1	4065	Wo	65	.....	A					
26.0	Tu	Me	M	V	T	S	P	C, O	13.5	2000	1M, 2T	S	6.0	3600	GE	5.0	1	A	.....	.....	.....	490	11.0
10.6	Tu	Me	M	V	.....	D	P	C	12.5	2000	1M, 3T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	210	.....
35.0	Tu	.....	.....	.....	.....	.....	P	C	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12.0	Tu	Me	M	V	M	S, Hy	P	C, O	14.0	2400	1M, 3T	R	5.0	3600	GE	.....	1	A	.....	2	Ad	280	11.5
.....	Re	.....	MT	S, D	MT	D, Hy	P	C, BL	14.6	2300	2M	R	6.5	.....	.....	60	2	.....	.....	.....	.....	300	6.5
.....	Pl	.....	M	D	M	S	P	C	.....	.....	1M, 1T	.....	2.5	.....	GE	1.0	2	A	.....	.....	.....	70	3.5
9.5	.....	.....	.....	.....	.....	.....	SS	C[8]	.....	.....	.....	.....	3.0	3600	GE	35	....	A	.....	.....	.....	.....	.....
0	.....	Me	M	D	M	V	UF(151)	C	11.6–14.0	2300–2650	1M, 2T	S, R	4.5	3600	GE	.....	1	A	2.0	2	Ad	305	8.5
0	.....	Me	2Mp	D	2Mp	V	SS(158)	C					2.0	3600	GE	105	....	A					
3.4	Tu	Me	2Mp	V	2Mp	V	SS(130)	C	12.5	2200	1T	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	68	1.0
.....	.....	Me	M	D	M	D	SS(168)	C, G[8]	11.5	2200	2T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	160	1.5
.....	.....	Me	M	.....	T	.....	UF(190)	C	13.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10.3	Tu	Me	M	S, V	M	S, D	SS(337)	C	13.0	.....	1M, 1T	R	2.5	3600	GE	22	....	A	.....	2	Ad	210	2.5
17.9	Tu	Me	MT	D	MT	D	P	C, O, G	9.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	380	2.5
.....	.....	.....	M	V	.....	.....	TG(284)	C	12.0	2400	1M, 1T	S, R	5.0	3600	WE	1.0	1	A	5.0	2	Mu	416	18.0
.....	.....	.....	.....	.....	.....	.....	HF, G	HF	.....	.....	.....	.....	1.5	3600	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	E	.....	.....	.....	.....	.....	BL	.....	.....	.....	.....	2.5	3600	AC	1.0	1	A	4.5	2	Ad	140	55.0
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	500	12.5
8.8	Tu	Me	M	S, D	M	S, D	P	C	13.0	2140	.....	.....	2.5	3600	GE	18.0	....	A	.....	.....	.....	.....	.....
2.0	Tu	Me	MT	D	M	D	SS(104)	C	13.8	2460	1M, 1T	S	1.5	3600	Wo	30.0	....	A	.....	.....	.....	220	2.5
2.6	Tu	Me	M	V	M	V	SS(121)	C	10.1	2000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	120	2.0
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	120	4.5
0	.....	.....	.....	S	M	S	G	G	1160[9]	.....	1M, 1T	R	1.0	4500	Wo	1.0	2	....	92.0[18]	.....	.....	.....	.....
0	.....	.....	T	S	T	S	G	G	1160[9]	.....	.....	.....	1.0	4500	Wo	1.0	2	.....	.....	.....	.....	110	2.0
21.3	Tu	.....	.....	.....	T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12300	.....
.....	.....	.....	.....	.....	M	D	O, G	G	.....	974[4]	3T	.....	1.5	3600	GE	30.0	....	A	.....	.....	.....	60	8.0
2.9	Tu	Me	M	V	M	D	SS(165)	C, WW	10.5	2150	2T	S, R	2.0	3600	AC	1.0	3	A	1.5	2	Ad	45	2.0
30.0	Re	Me	M	V	M	S, D	P	C	13.5	2000	1M, 1T	S, R	7.5	3600	GE	1.0	2	A	8.5	2	Ad	1000	22.5
7.3	Tu	Me	M	D	T	S	SS(212)	G[10]	1050[9]	.....	1M	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	736	16.0
16.6	Tu	E	T	S	T	S	BL	BL	3.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11.6	Tu	Me	M	D	T	S	SS(222)	O[10]	18.4	.....	2M	R	10.0	3600	GE	1.25	2	A	11.0	2	AlBr	1630	30.0
13.3	Tu	.....	M	D	M	D	P	C, O	12.5	2650	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
0	.....	Me	MT	S	T	S	SS(195)	C	14.3	2800	4M	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	225	.....

P —Pulverized-fuel firing
Pl —Plate
R —Regulator
R —Regenerative
RS —Riley Stoker Corp
S —Speed control
SS —Spreader stoker
ST —Slag tap
T —Turbine drive
TG —Traveling-grate stoker

Tu —Tubular
UF —Underfeed stoker
UI —Union Iron Works
V —Vane control
Vo —Henry Vogt Machine Co
W —Wood
WH —Waste heat
WB —Wm Bros Boiler & Mfg Co
WE —Westinghouse Electric Corp
Wi —Wickes Boiler Co

Wo —Worthington Pump & Machy Corp, Moore Steam Turbine Division
WW —Wood waste
1—Coke breeze
2—Blast-furnace gas
3—Btu per cu ft
4—Separately heated preheater
5—Wood refuse

6—Design pressure for future use
7—Mercury boiler; steam units are condenser-boilers
8—Lignite
9—Waste cork dust
10—Bark
11—Coke-ove n gas
12—Wesarn, Vreeland, Carlson & Sweatt
18—Air-cooled condenser
(150)—Stoker grate area, sq ft

1949 Design Survey of Typical Industrial and

For notes on uses and limitations of this tabulation • See page 96

Compiled by J C McCabe, Associate Editor

Company	Location	Consulting Engineers	First Operation, New Units	BOILERS: Nominal Pressure, psi	BOILERS: Nominal Steam Temperature, F	BOILERS: Number	BOILERS: Capacity, Each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Heating surface, 1000 sq ft	BOILERS: Furnace Volume, 1000 cu ft	BOILERS: Heat Release, 1000 Btu per cu ft per hr	BOILERS: Furnace bottom	BOILERS: Economizer Surface per Boiler, 1000 sq ft
Rhinelander Paper Co	Rhinelander, Wis		4-48	425	580								
Union Bag & Paper Corp	Savannah, Ga			425	725	1	145	CE					
Emery Industries, Inc	Cincinnati, Ohio	W W Carlton & Assoc	4-49	420	650	1	125	BW	10.3	7.3	22.1	DB	
Imperial Oil Co, Ltd	Montreal, Que	Standard Oil Development	6-48	420	625	2	100	BW	13.1	9.2	21.9	DB	
Burroughs Adding Machine Co	Detroit, Mich	Albert Kahn	3-49	415	600	1	60	UI	6.4	2.0			1.1
Michigan Carton Co	Battle Creek, Mich		7-48	415		2	60			7.3			2.1
American Enka Corp	Lowland, Tenn		1948	410	750	3	130	BW	11.3	8.7		DB	
Container Corp of Amer	Chicago, Ill	Sargent & Lundy	1950	400	750	1	115	RS				DB	
Fairfield Paper & Container	Baltimore, Ohio	W I Barrows	5-49	400	750	1	80	BW	8.6	4.8	24.8	DB	3.1
Freeport Sulphur Co	Port Sulphur, La	Sargent & Lundy		400	Sat	2	35	BW				DB	
International Harvester Co	Chicago, Ill			400	700	1	150	EM	25.7	11.3			6.3
International Paper Co	Springhill, La		3-49	400	700	1	55	BW	9.2	5.0	19.0	ST	2.4
						1	150	BW	14.4	6.6	31.0	DB	0
Mohawk Carpet Mills	Amsterdam, N Y		12-49	400	700	1	80	CE	8.8				3.3
B F Nelson Mfg Co	Minneapolis, Minn	F L Smith	6-49	400	650	2	85	WB	9.8	4.4	29.2		3.4
Parker-Browne Co	Fort Worth, Texas		5-49	400	550	1	30	Vo	5.8	2.5	15.8		2.5
U S Gypsum Co	South Gate, Calif			400	750								
University of Illinois	Champaign, Ill	Sargent & Lundy	9-48	400	650	1	80	BW	9.7	3.6	29.6	DB	4.6
300 TO 399 PSI													
Inland Steel Co	East Chicago, Ind			375	700	3	250	CE	23.6				11.6
Washington University	St Louis, Mo			375	600	3	40	UI	5.4	1.3		DB	0
Inspiration Consol Copper Co	Inspiration, Ariz	Chemical Constr Corp	9-49	350	Sat	1		CE					
U S Rubber Reclaiming Co Inc	Buffalo, N Y		7-45	350	437	1	60	RS	7.9	2.9	25.2	DB	0
American Cyanamid Corp	Linden, N J	Chemical Constr Corp	4-49	325	Sat	1	50	FW	3.4				4.1
Angelina Cnty Lumber Co	Keltys, Texas	H E Bovay, Jr	5-49	325	550	1	40	Wi					
Consolidated Badger Co-op	Shawano, Wis			325	600	1	30	UI	3.6	1.5	30.0	DB	0.3
						1	50	UI	5.5	2.3	30.0	DB	0.3
Canadian Pacific Rwys	Montreal, Que		1949	300	550	3	35	DBr					
Elect Magnesium Mfg Co	Valley Forge, Pa	Kuljian Corp		300	422	3	12.5	Ke					
E I du Pont de Nemours & Co	Camden, S C		5-50	300	414	2	45	BW	5.1	1.7	31.7	DB	1.7
Johns Manville Prod Corp	Jarratt, Va		4-49	300	Sat	1	75	EC	15.4	3.0	30.2	DB	0
Lion Oil Co, Chem Div	El Dorado, Ark	Chemical Constr Corp	8-49	300	550	1	50	FW	4.0				4.1
Owens-Corning Fiberglas Corp	Santa Clara, Calif	Austin Co	7-49	300	600	2	40	RS	5.0	2.2	27.0	DB	0.9
Utah Idaho Sugar Co	Idaho Falls, Idaho		10-48	300	421	1	125	EC	16.4	3.7	30.0	DB	0
200 TO 299 PSI													
Oklahoma A & M College	Stillwater, Okla		1-50	280	640	3	45	Vo					
Canadian Industries, Ltd	Shawinigan Falls, Que		1949	275	Sat	2	75	DBr					
Cities Service Oil Co	E. Chicago, Ind		2-49	275		1	100	RS					
Mc Coll Frontenac Oil Co	Montreal East, Que			275	500	3	54	DBr					
Lever Bros, Ltd	Toronto, Ont	Stone & Webster	7-49	275	414	3	87	BWG	9.6	3.8	27.3	DB	3.0
Rock Hill Printing & Finishing	Rock Hill, S C		8-49	275	550	1	150	CE					
Arms Textile Mfg Co	Manchester, N H	R M Youssoufian	10-49	270	353	2	25	RS	4.3	1.5	30.9	DB	
American Thread Co	Bristol, Tenn	Interboro Heating Co	2-49	250	Sat	1	35	Bi	4.3	2.7	16.5	DB	
Bartgis Bros	Ilchester, Md	Westcott & Mapes	11-49	250	490	1	60	Bi	9.1	3.7	21.0		
Buckeye Cotton Oil Co	Louisville, Ky	Day & Zimmerman	12-48	250	Sat	1	25	BW	4.8	1.3	25.0		
California Co	Rangely, Colo	Hudson Engrg	12-48	250	401	2	15	Vo					
Canadian National Rwys	Stratford, Ont		1948	250	415	2	33	DBr					
Champlain Dry Dock Co	Lauzon, Que		1948	250	490	4	23	DBr					
						1	9	DBr					
Dennison Mfg Co	Framingham, Mass		2-49	250	Sat	1	35	Bi	4.3	2.2	21.0		
			7-49	250	Sat	1	35	Bi	4.3	2.2	21.0		
Ford Motor Co	Detroit, Mich		1948	250	416	2	40	CE					
Glenn L Martin Co	Painesville, Ohio	Blaw-Knox Co	1948	250	401	2	40	BW	5.9				
Heintz Mfg Co	Philadelphia, Pa	H M Kuljian		250	Sat	1	30	FM	4.1				
International Salt Co	Watkins Glen, N Y	Zack C Hinds	2-49	250	506	2	55	UI	6.8	2.0	33.4		
Jones & Laughlin Steel	Pittsburgh, Pa	Rust Engrg Co		250[a]	466	5	175	BW	19.1	8.6	26.7		0
Libbey-Owens-Ford Glass Co	Ottawa, Ill		11-49	250	550	1	150	BW	13.8				4.5
Molson's Brewery, Ltd	Montreal, Que		1949	250	Sat	1	50	DBr					
New Hampshire State Hosp	Concord, N H	R D Kimball Co	9-49	250	Sat	1	60	Bi	8.3				
Nicholson File Co	Anderson, Ind	Jenks & Ballou		250	Sat	2	40	RS	5.4				
Phillips Chemical Co	Etter, Texas	Chemical Constr Corp	7-49	250	Sat	2	50	FW	9.8				
Publishers Paper Co	Oregon City, Ore	H W Beecher	12-49	250	488	1	110		10.1		26.0		
Stanley Works	New Britain, Conn		9-49	250	525	1	50	Bi	6.2				
Texas Co	West Tulsa, Okla	W, V, C & S[a]	10-49	250	500	3	170	BW	16.7	9.4	25.0	DB	0
Textron, Inc	E Greenwich, R I	J C Bogue	1-49	250	Sat	1	20	Bi	3.1				
Univ of California	Berkeley, Calif		9-49	250	Sat	1	100	EC	11.0	4.0	30.0	DB	
R T French Co	Rochester, N Y	Zack C Hinds	12-47	240	Sat	3	22.5	BW	2.8	0.6	47.3		
Refined Syrups & Sugars	Yonkers, N Y			240	455		30	RS	11.4	3.0	25.0	DB	0
Standard Wholesale Phos & Acid	Baltimore, Md	Chemical Constr Corp	1-49	240	Sat	1	63	FW	5.0				
Rohm & Haas	Bridesburg, Phila., Pa	Stone & Webster	1947	235	400	3	75	BW	8.2	3.9	23.4	DB	0
Heyden Chem Corp	Rumford, R I	Chemical Constr Corp	11-49	230	Sat	1		EC					
British American Oil Co	Montreal East, Que		1949	225	480	1	75	DBr					
Forstmann Woolen Co	Passaic, N J	Stone & Webster		225	500								
General Motors Corp	Norwood, Ohio		2-49	225	Sat	1	60	BW	7.4		30.0		
Kansas State College	Manhattan, Kan			225	550								
Maytag Co	Newton, Iowa	Brown Engrg	5-49	225	Sat	2	40	BW	5.1	2.0	24.3		2.0
Provincial Paper Ltd	Port Arthur, Ont	H G Acres & Co	10-49	225[a]	500	1	95	FW	12.0	4.1	28.5		0
Vacuum Foods Corp	Leesburg, Fla			225	Sat	1	45						
	Plymouth, Fla			225	Sat	1	45						
Orangeburg Mfg Co	Orangeburg, N Y	Sanderson & Porter		210	Sat	3	30	CE					
Tennessee Coal, Iron & RR	Fairfield, Ala		4-49	205	570	1	27	CE	7.9				
Carborundum Co	Niagara Falls, N Y	Neile, Rich & Bladen	6-49	200	388	2	60	BW	6.5	2.5	28.7		0

A —Air cooled
AAd —Arsenical admiralty
AlBr —Aluminum-brass
AC —Allis-Chalmers Mfg Co
AsCu —Arsenical copper
Ad —Admiralty
Bi —Bigelow Co
BL —Black liquor
BW —Babcock & Wilcox Co
C —Coal, bituminous
CA —Coal, anthracite
CB —Cleaver-Brooks Co
CE —Combustion Engineering-Superheated Inc
Cu —Copper
CuNi —Copper nickel
CV —Canadian Vickers, Ltd
D —Dutager
DB —Dry bottom
DBr —Dominion Bridge Co
DL —DeLaval Steam Turbine Co
Du —Duplex pump
E —Electrostatic
EC —Erie City Iron Works
El —Elliott Co
EM —Edge Moor Iron Works, Inc
FW —Foster Wheeler Corp
G —Gas
GE —General Electric Co
H —Hydrogen cooled
HF —Hogged fuel
Hy —Hydraulic coupling
Ke —E Keeler Co
M —Motor drive
Ma —Magnetic coupling
Me —Mechanical
Mp —Two motors per fan
MT —One motor, one turbine per fan
Mu —Muntz metal
O —Oil

Institutional Power Plants: 200 Psi or Above

Air-Heater Surface per Boiler, 1000 sq ft	Air-Heater Type	Dust Collectors	F-D FANS: Drive	F-D FANS: Air-Volume Control	I-D FANS: Drive	I-D FANS: Gas-Volume Control	FUEL: Firing	FUEL: Type	FUEL: Heating Value, 1000 Btu per lb	FUEL: Ash-Fusion Temperature, F	FEED PUMPS: Drive	FEED PUMPS: Flow Control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of Bleed Points	TURBINES: Generator, Cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. Water Passes	CONDENSERS: Tube Material	Total Boiler Capacity Incl New Units, 1000 lb	Total Generator Capacity Incl New Units, 1000 kw
							Bl	Bl					2.0	3600	GE			A	3.8	2	Cu Ni	450	14.0
17.6	Tu	Me	M	V	M	Hy	P	C, O	14.1	2880	1M, 1T	S, R										225	
14.1	Tu		T	S, D	T	S, D	O, G	O	18.7		1M, 2T	R										360	
			M	D	M	D	SS	C	13.5	2250	1T	R	3.0	3600	AC	1.0	4	A	4.5	2	Ad	60	3.0
			M	V	T	S	SS	C	12.0	2000			0.9		WE	50		A				120	
21.7	Tu	Me	T	D	T	S	P	C	14.0	2660	1M, 2T	R	5.0	3600	E1		1	A	6.5	2	Ad	390	14.2
													5.0	3600	E1	20		A					
		Me	M	D	M	D	TG	C	11.0		1M, 1T	R	4.0	3600	WE	50		A				165	4.6
		Me	M	V	T	D	SS(180)	C	11.7	2000	1M, 1T	S, R										140	
							G	G					2.0			20	1	A					
21.2	Tu	Me	T		T		TG	O[2]															
8.2	Tu	E	M	D	T	S	BL	BL	3.9				6.0	3600	GE	1.25	2	A	6.0	2	Ad	1050	28.5
0	0		M	D	M	D	G	G	1050[2]														
		Me	MT	V	MT	Hy	SS(207)	C	14.0	2500	1M, 1T	R										450	8.5
		Me	1M, 1T	S, D, V	1M, 1T	S, D	SS(230)	C, O, G	13.0	2200	1M, 1T	R	3.75	3600	GE	1.25	1	A	2.3	2	Ad	170	37.5
					M	D	G, O	G	1000[3]		2T	R	0.5	5000	GE	30		A				50	0.75
													3.0	3600	AC	25	1	A					
15.1	Tu		M	V	M	V	UF(284)	C	10.5		1M	S	3.0	3600	GE	1.0	2	A	3.5	2	As Cu	320	9.0
							P	C[2]															
			M	S, D			TG(91)	C	11.0	2100	1M, 2T	S, R	0.3	3600		5.0		A				120	1.5
													0.8	3600		5.0		A					
							WH																
6.1	Tu	Me	MT	Hy	MT	Hy	P	C	13.8	2500	2M, 2T	R										123.6	
							WH				1M, 2T	S											
					M	D	HF, WW				1M, 1T	S, R											1.0
2.0	Re		M	V	T	S	SS(99)	C	14.0	2500	2M	R	1.0	3600	Wo	5.0	1	A				80	1.0
9.0	Tu		M	V	T	S	P	C	11.0	2500													
							TG	C, A															
	Tu		M, T		M, T		O	O	18.4		M, T	R											
		Me	T	S	T	S	SS(114)	C	13.0	2100	2T	R										90	
5.6	Tu	Me	MT		MT		SS(143)	C	14.2	2100	M, T	S										180	
							WH				1M, 1T	R											
0				D	MT	S, D					1M, 1T	S, R										80	0.5
0			T	D		D	SS(302)	C	12.2		1M, 2T	S	1.5	3600	Wo	35	1	A				200	1.5
							O, G	O, C					4.5	3600	E1	1.0	1	A				135	45
							TG	CA															
8.2																						300	
							0	0															
0		Me	1M, 2T	D, V	3T	S, D	SS(174)	C	14.6	2375	1M, 2T	S										261	
	Re		T	S	1M, 1T	S, Ma	P	C	12.5	2200	3M, 1T	R										350	8.5
0.6			M	D, V	M	D, V		O			1M, 1T	R										25.0	
							P	C															
		Me	MT	V	MT	D	SS	C															
			M	V	M	D	TG(123)	C	11.5	1900	2T	R										43	
							O	O														50	1.0
							UF	C															
							O	O															
							O	O															
							P	C, O															
							P	C, O															
	Tu						O	O															
			MT	S			SS				1M, 2T	R										80	0
			M				SS																
3.8	Tu	Me	MT	D	MT	D	SS(127)	C	13.9	2240	1M, 1T	S	1.3	1200	Wo	12		A				110	1.8
9.8	Tu	Me	MT, 4T	S, D	MT, 4T	S, D	SS(305)	C[11]	10.2	2303	4T											873	
0			M	D	M	V	SS(347)	C	10.4	1950	2M, 1T	R										410	15.5
							O	O															
							SS(144)	C															
			1M, 1T	S, D			TG(116)	O, G			2M, 1T	R											
					MT	D	WH																
11.6	Tu	Me	T	V	T	S	O	O, HF			1M, 1T	S	1.0	3500	Wo	30						280	
							O	O														150	
12.5	Re		T	S	T	S	O, G	O, G			1M, 2T	S										510	
							O	O															
7.8			T	S, D	T		O, G	O, G	1050[3]		1M, 1T											196	
			M	V		D	UF(62)	C	13.6	2500	1M, 1T	S, R										67.5	
4.5	Tu		M	S, D	M	S, D	P	C	14.0	2600	1M, 2T	S	2.0	3600	Wo	15		A				120	3.6
5.3							WH				1M, 1T	R											
2.7	Tu	Me	T	S, D	T	S, D	SS(158)	C	13.5	2050	1M, 2T	R	0.5	3600	WE	70		A				225	0.5
							WH				2Da												
							O	O															
													2.0	3600	GE	1.0	1	A	2.5	2	Ad		3.6
		Me	MT	D	M	D	SS(161)	C	14.4		1M, 1T	R				10						146	
													2.0	3600	WE	19.0		A					
													1.0	3600	WE	19.0		A				170	3.8
													0.75	3600	WE	1.25		A	1.0	2	Ad		
0		Me	T	S	T	D	SS(109)	C	9.0	1800	1M, 2T	R										80	
4.5	Tu	Me	M	V	M	D	SS(224)	C	13.1	2075	1M, 1T	R										223	
							O	O														45	
							O	O														45	
		Me	M	S	M	S	SS				2T	R	1.0	3600	Wo	15		A				90	1.3
													0.3	3600	AC	15		A					
			T	D		D	TG(117)	G[1]	540[3]		2T	R										216	
3.9	Tu	Me	M	D, V	T	S, D	SS(127)	C	12.5	2090	2M											120	

P —Pulverized-fuel firing
Pl —Plate
R —Regulator
Re —Regenerative
RS —Riley Stoker Corp
S —Speed control
SS —Spreader stoker
ST —Slag tap
T —Turbine drive
TG —Traveling-grate stoker
Tu —Tubular
UF —Underfeed stoker
UI —Union Iron Works
V —Vane control
Vo —Henry Vogt Machine Co
W —Wood
WH —Waste heat
WB —Wm Bros Boiler & Mfg Co
WE —Westinghouse Electric Corp
Wi —Wickes Boiler Co
Wo —Worthington Pump & Machy Corp, Moore Steam Turbine Division
WW —Wood waste
1—Coke breeze
2—Blast-furnace gas
3—Btu per cu ft
4—Separately-heated preheater
5—Wood refuse
6—Design pressure for future use
7—Mercury boiler; steam units are condenser-boilers
8—Lignite
9—Waste cork dust
10—Bark
11—Coke-oven gas
12—Wearn, Vreeland, Carlson & Sweatt
(150)—Stoker grate area, sq ft

1949 Design Survey of Typical Industrial and

For notes on uses and limitations of this tabulation • See page 96

Compiled by J C McCabe, Associate Editor

Company	Location	First Operation, New Units	Nominal Pressure, psi	Nominal Steam Temperature, F	BOILERS: Number	BOILERS: Capacity, each 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Firing	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of Bleed Points	Total Boiler Capacity Incl New Units, 1000 lb	Total Generator Capacity Incl New Units, 1000 kw
160 TO 200 PSI															
Amer Inst of Laundering	Joliet, Ill	4-49	200	Sat	1	21	BW	SS							
Artloom Carpet Co, Inc	Philadelphia, Pa	1948	200	366	1	65	BW	UF							
Ballard Oil Co of Hartford	New London, Conn	2-49	200	Sat	2	12	Bi	O							
Best Foods, Inc	San Francisco, Calif	7-49	200	Sat	2	40	Bi	O, G							
Columbia Steel Co	Pittsburg, Calif	10-48	200	Sat	2	58		O, G							
Crucible Steel Co of Amer	Midland, Pa	12-48	200	465	2	75	BW	P							
Electro-Motive Div, GM	La Grange, Ill	7-48	200	416	2	150	BW	SS							
Esso Standard Oil Co	Bayonne, N. J	1-50	200	475	2	200	RS	O							
International Silver Co	Wallingford, Conn	8-49	200	Sat	1	10	Bi	O						70	
					2	30	Bi	O							
Johns Manville Corp	Natchez, Miss	4-48	200	Sat	1	30	BW	SS(100)							
			200	Sat	1	20	EC	G							
Monument Mills	Housatonic, Mass	6-49	200	Sat	1	48	Bi	UF							
Ohio Cultivator Co	Bellevue, Ohio	7-49	200	Sat	1	25	Vo	SS							
Oregon State College	Corvallis, Ore		200	Sat	1	25	BW	O, HF							
Pennsylvania RR	Washington, D C		200	100	1	50	EM	UF							
Sanco Piece Dye Wks	Phillipsburg, N. J		200	Sat	1	70	EM	TG							
Sloane-Blabon Corp	Philadelphia, Pa	6-49	200	Sat	1	50	EM	SS							
M T Stevens & Sons Co	Haverhill, Mass	12-49	200	Sat	1	32	Bi	P							
Tennessee Coal, Iron & RR	Ensley, Ala	11-49	200	600	8	75	BW	BFG	10.0	3600	WE	1.2			
Torrington Co	Torrington, Conn	9-49	200	Sat	1	23	Bi	SS(63)						45	
Western Elec Co	Indianapolis, Ind		200	Sat	3	60	UI	SS							
Standard Clay Prod	New Glasgow, N. S		195	Sat	1	15	DBr	SS							
Sanatorium de Gaspe	Gaspe, Que		192	353	2	6	CV	UF							
University of Michigan	Ann Arbor, Mich	11-48	190	Sat	1	150	Wi	UF(312)							
John D Grover & Sons	Philadelphia, Pa		188	Sat	1	40	EM	O							
Amer Agricultural Chem	Detroit, Mich	9-48	180	450	1	50	BW	SS(139)							
Anderson Pritchard Oil Co	Cyril, Okla		180	380	1	39	EC	O, G							
Austell Box Board Corp	Austell, Ga	5-49	180	Sat	1	32	BW	TG							
Evans Products Co	Coos Bay, Ore		180	450	2	35	BW	HF	2.5	3600	WE		1	70	3.25
									0.75	3600	GE	60			
Producers Creamery Co	Lebanon, Mo	3-49	180	360	2	25	UI	O	0.2	227	SE	10		50	0.4
American Woolen Co	Lawrence, Mass		175	430	3	60	CE	O						180	5.0
Chrysler Corp, Airtemp Div	Dayton, Ohio	1947	175	Sat	3	30		SS						90	
Chrysler Corp, Dodge Div	Dayton Ohio	1949	175	Sat	1	90		UF						90	
Ford Motor Co	Atlanta, Ga	3-48	175	Sat	3	40	Wi	O, G						120	
Ford Motor Co	Los Angeles, Calif	11-48	175	Sat	2	40	Wi	O, G						80	
Ford Motor Co	Metuchen, N. J	6-48	175	Sat	3	60	Wi	O							
Ford Motor Co	St. Louis, Mo	12-48	175	Sat	3	60	Wi	O, G							
Gehl Guernsey Farms	Germantown, Wis		175	Sat	2	25	Wi	SS	0.5	3600	AC	6.0	1	50	0.5
Hillsboro Woolen Mills	Hillsboro, N. H		175	Sat	1	25	Wi	SS	0.4	360	SE	6.0		40	
					1	15	Bi	SS							
Holly Sugar Corp	Torrington, Wyo		175	Sat	4	20	BW	O, G	1.5	3600	GE	27.5		230	2.75
									1.25	3600	AC	27.5			
International Harvester Co	Evansville, Ind		175	375	1	70	Vo	SS						177.5	
Mid-Continent Petroleum	Tulsa, Okla		175	477	8	45	Vo	O, G							
Singer Sewing Machine Co	South Bend, Ind	11-49	175	500	2	25	BW	TG(110)						100	
Stroux Co, Inc	Clayville, N. Y		175	Sat	1	40	EM	SS(143)							
Abbeville Mills Corp	Abbeville, S. C	1-49	160	Sat	1	17	BW	UF						30	
Armstrong Cork Co	Jackson, Miss	9-46	160	Sat	1	8	Ke	O							
Armstrong Cork Co	Kankakee, Ill	6-46	160	Sat	1	8	Ke	O						23	
					1	15	Ke	O							
Brown & Bigelow	St Paul, Minn	1-49	160	470	2	30	UI	SS(76)	0.3	3600	Wo	2	0	74	1.75
Canada Malting Co	Port Arthur, Ont	1948	160	Sat	2	15	DBr	SS							
Canadian Cooper Refineries	Montreal East, Que	1949	160	Sat	1	20	DBr								
Christie Brown Co	Toronto, Can	1948	160	Sat	1	5	BW	O, G						25	
					2	11	BW	O, G							
Citadel (Military College)	Charleston, S. C		160	353	1	34	BW	UF							
Columbus-McKinnon Chain	Tonawanda, N. Y		160	Sat	2	15	EC								
Crown Paper Board Co	Philadelphia, Pa	1948	160	Sat	1	45		O						100	
Dominion Bridge Co	Lachine, Que	1948	160	Sat	2	23	DBr	UF							
					1	23	DBr	O							
General Foods Corp	Kankakee, Ill	9-47	160	Sat	1	40	BW	SS(118)						76	
Harshaw Chemical Co	Cleveland, Ohio	1-49	160	353	1	45	BW	SS(128)						105	
Joseph Heacock Co	Woodside, Pa	7-49	160	Sat	2	13	Bi	TG							
Holliston Mills Co	Kingsport, Tenn		160	396	2	18.7	BW	UF(53)							
Jackson Brewing Co	New Orleans, La		160	353	2	26	BW	O						78	
					1	26	MI	O							
Kelsey Hayes Wheel Co	McKeesport, Pa		160	Sat	1	25	CE	UF							
					1	45	CE	UF							
Kingsport Press, Inc	Kingsport, Tenn	6-49	160	353	1	21.5	BW	SS(70)							
Koppers Co	Russell, Ky	1-49	160	373	1	20	BW	SS							
Laurentide Dairy Prod	Three Rivers, Que	1949	160	Sat	1	18	DBr	UF							
Louisville Rwy	Louisville, Ky		160	Sat	1	20	Vo	UF							
Brown Instrument Div, Minneapolis-Honeywell Reg	Philadelphia, Pa	1-49	160	353	1	18.5	BW	O							
Mont Joli Sanatorium	Mont Joli, Que	1949	160	Sat	1	11	BW	O							
					2	18	DBr	UF							

AC —Allis-Chalmers Mfg Co
BB —Birchfield Boilers, Inc
BFG —Blast-furnace gas
Bi —Bigelow Co
BW —Babcock & Wilcox Co
BWG—Babcock-Wilcox & Goldie-McCulloch Ltd
C —Coal, bituminous
CA —Coal, anthracite
CB —Cleaver-Brooks Co
CE —Combustion Engineering-Superheater Inc
CV —Canadian Vickers, Ltd
D —Damper
DBr —Dominion Bridge Co
DL —DeLaval Steam Turbine Co
Du —Duplex pump
EC —Erie City Iron Works
El —Elliott Co
EM —Edge Moor Iron Works, Inc
FW —Foster Wheeler Corp
G —Gas
GE —General Electric Co
HB —Heilman Boiler Works
HF —Hogged fuel
Hy —Hydraulic coupling
JI —John Inglis Co, Ltd
Ke —E Keeler Co
KR —Kewanee Boiler Corp
MI —Murray Iron Works Co
O —Oil
P —Pulverized-fuel firing
PB —Pacific Steel Boilers Corp
R —Regulator
RS —Riley Stoker Corp
S —Speed control
SE —Skinner Engine Co
SS —Spreader stoker
T —Turbine drive
TG —Traveling-grate stoker
Ti —Titusville Iron Works Div
UF —Underfeed stoker
Ui —Union Iron Works
V —Vane control
VK —Vickers Keeler Co
Vo —Henry Vogt Machine Co
W —Wood
WH —Waste Heat
WB —Wm Bros Boiler & Mfg Co
WE —Westinghouse Electric Corp
Wi —Wickes Boiler Co
Wo —Worthington Pump & Machy Corp
WW—Wood waste
(150)—Stoker grate area, sq ft

Institutional Power Plants: Below 200 Psi

For notes on uses and limitations of this tabulation • See page 96

Compiled by J C McCabe, Associate Editor

Company	Location	First Operation, New Units	Nominal Pressure, psi	Nominal Steam Temperature, F	BOILERS: Number	BOILERS: Capacity, each 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Firing	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of Bleed Points	Total Boiler Capacity Incl New Units, 1000 lb	Total Generator Capacity Incl New Units, 1000 kw
Mont St Louis Institute	Montreal, Que	.....	160	Sat	1	18	DBr	UF	.....	.....	.....	.....	.....	.....	.....
F G Nagle Co	Detroit, Mich	10–48	160	Sat	1	13	Bi	UF	.....	.....	.....	.....	.....	.....	.....
National Biscuit Co	East Liberty, Pa	1949	160	.....	2	20	.....	O, G	.....	.....	.....	.....	.....	.....	.....
National Biscuit Co	Houston, Texas	1949	160	.....	2	11	BW	O, G	.....	.....	.....	.....	.....	.....	.....
National Biscuit Co	Portland, Ore	1949	160	.....	2	13	Wi	O, G	.....	.....	.....	.....	.....	.....	.....
New York Central RR	Buffalo, N. Y.	6–49	160	Sat	1	45	EC	SS(84)	.....	.....	.....	.....	.....	95	.....
Producers Creamery Co	El Dorado Springs, Mo	2–49	160	.....	2	10	UI	P	.....	.....	.....	.....	.....	.....	.....
Quaker Oats Co	Sherman, Texas	.....	160	Sat	1	15	.....	O, G	.....	.....	.....	.....	.....	.....	.....
Ralston Purina Co	Bloomington, Ill	8–49	160	370	2	25	EC	SS(75)	.....	.....	.....	.....	.....	.....	.....
Shamrock Hotel	Houston, Texas	3–49	160	Sat	3	26.5	BW	G	.....	.....	.....	.....	.....	.....	.....
Shell Oil Co, Inc	Sewaren, N. J	6–48	160	364	1	75	BW	.....	.....	.....	.....	.....	.....	143	.....
St. Cloud State Teachers College	St. Cloud, Minn	.....	160	Sat	1	.....	WB	UF	.....	.....	.....	.....	.....	.....	.....
St. Thomas Hospital	Nashville, Tenn	.....	160	370	2	21	EC	O, G	.....	.....	.....	.....	.....	.....	.....
State Hospital	Goldsboro, N. C	.....	160	365	1	35	RS	P	0.5	3600	Wo	25	0	105	0.5
Stockton State Hospital	Stockton, Calif	1948	160	Sat	1	45	EC	O	.....	.....	.....	.....	.....	.....	.....
Terrace Plaza Hotel	Cincinnati, Ohio		160	Sat	3	34	BW	O	.....	.....	.....	.....	.....	.....	.....
Trenton Chemical Co	Trenton, Mich	2–49	160	370	1	50	EC	SS(188)	.....	.....	.....	.....	.....	.....	.....
Veterans Administration	Erie, Pa	1950	160	Sat	3	10	EC	SS	.....	.....	.....	.....	.....	.....	.....
Waterbury Hospital	Waterbury, Conn	8–49	160	Sat	1	23	Bi	O	.....	.....	.....	.....	.....	.....	.....
Wilcox Co	Bristow, Okla	.....	160	Sat	1	15	Vo	.....	.....	.....	.....	.....	.....	.....	.....
150 TO 159 PSI															
Manhattan Blr & Equip Co	New York, N. Y	.....	154	Sat	1	13	Bi	O	.....	.....	.....	.....	.....	.....	.....
Agawam Dye Wks	Lawrence, Mass	2–49	150	338	1	9	CB	O	.....	.....	.....	.....	.....	.....	.....
American-Marietta Co	Seattle, Wash	1948	150	345	2	16	CB	O	.....	.....	.....	.....	.....	.....	.....
Aurora Gasoline Co	Detroit, Mich	2–49	150	Sat	1	15	Bi	O	.....	.....	.....	.....	.....	.....	.....
Baltimore & Ohio RR	Grafton, W. Va	1946	150	Sat	2	9	BW	UF	.....	.....	.....	.....	.....	.....	.....
Cashman Laundry	Bronx, N. Y	1948	150	Sat	.....	.....	.....	.....	0.2	200	SE	17	.....	.....	.....
Chef-Boy-Ar-Dee Div	Milton, Pa	1946	150	366	5	42	Ke	UF(92)	.....	.....	.....	.....	.....	210	.....
Congoleum-Nairn Inc	Marcus Hook, Pa	1948	150	470	2	70	BW	P	.....	.....	.....	.....	.....	200	0.4
Eastern Malleable Iron	Naugatuck, Conn	12–48	150	Sat	2	10	Bi	O	.....	.....	.....	.....	.....	.....	.....
Fibertex Corp	Portsmouth, N. H	4–49	150	Sat	1	10	Bi	O	.....	.....	.....	.....	.....	.....	.....
Galveston-Houston Breweries	Galveston, Texas	.....	150	Sat	1	50	Vo	O, G	.....	.....	.....	.....	.....	.....	.....
General Foods Corp	Albion, N. Y	10–46	150	Sat	1	60	CE	SS(149)	.....	.....	.....	.....	.....	190	.....
General Motors Corp	Framingham, Mass	11–48	150	Sat	3	60	CE	O	.....	.....	.....	.....	.....	.....	.....
General Motors Corp	Wilmington, Md	1947	150	Sat	3	60	BW	O	.....	.....	.....	.....	.....	.....	.....
Georgia Railway Shops	Macon, Ga	.....	150	Sat	2	10	BW	SS	.....	.....	.....	.....	.....	.....	.....
Hanes Hosiery Mills	Winston-Salem, N. C	.....	150	366	1	10	CE	UF(51)	.....	.....	.....	.....	.....	.....	.....
Johns-Manville Corp	Asbestos, Que	11–47	150	Sat	1	25	VK	SS(90)	.....	.....	.....	.....	.....	65	.....
Johns-Manville Corp	Toronto, Ont	1948	150	Sat	3	25	JI	SS(81)	.....	.....	.....	.....	.....	75	.....
M-G-M Records	Bloomfield, N. J	.....	150	Sat	2	18	CB	.....	.....	.....	.....	.....	.....	.....	.....
Metal & Thermit Co	Baltimore, Md	2–49	150	Sat	1	13	Bi	O	.....	.....	.....	.....	.....	.....	.....
Ming Toy Dyeing Co	Haledon, N. J	1948	150	366	1	70	FW	O	.....	.....	.....	.....	.....	.....	.....
Navy YMCA	Brooklyn, N. Y	1948	150	Sat	.....	.....	.....	.....	0.15	225	SE	17	.....	.....	.....
Osborn Mfg Co	Henderson, Ky	10–48	150	Sat	1	.5	UI	SS	.....	.....	.....	.....	.....	.....	.....
Pittsburgh Plate Glass Co	Crystal City, Mo	10–49	150	Sat	3	55	EC	SS(110)	.....	.....	.....	.....	.....	229	.....
Provincial Paper Co	Port Arthur, Ont	10–49	150	4.5	1	95	FW	SS	.....	.....	.....	.....	.....	250	.....
St. Charles Hotel	New Orleans, La	1948	150	Sat	2	10	.....	.....	.....	.....	.....	.....	.....	.....	.....
Schneierson & Son, Inc	Fall River, Mass	8–49	150	Sat	2	10	Bi	UF	.....	.....	.....	.....	.....	.....	.....
South Dakota State College	Brookings, S. D		150	373	1	40	BW	UF	.....	.....	.....	.....	.....	.....	.....
Stromberg Carlson Co	Rochester, N. Y	11–48	150	Sat	1	29	BW	SS	.....	.....	.....	.....	.....	82	.....
Superior Laundry & Linen Supply	Chicago, Ill	2–49	150	Sat	2	13	Bi	O	.....	.....	.....	.....	.....	.....	.....
Swift & Co	Winona, Minn	.....	150	Sat	1	30	EM	SS	.....	.....	.....	.....	.....	.....	.....
Tennessee Coal, Iron & RR	Concord, Ala	8–49	150	Sat	2	5	CE	UF(60)	.....	.....	.....	.....	.....	.....	.....
University of Wyoming	Laramie, Wyo		150	Sat	1	40	BW	O, G	.....	.....	.....	.....	.....	84	1.15
Washington Lumber Co	Bowling Green, Va	11–48	150	Sat	1	10	Bi	.....	.....	.....	.....	.....	.....	.....	.....
Waterbury Farrel Foundry	Waterbury, Conn	8–49	150	Sat	2	8	Bi	UF	.....	.....	.....	.....	.....	.....	.....
Westfield Mfg Co	Westfield, Mass	12–49	150	Sat	1	13	Bi	C	.....	.....	.....	.....	.....	.....	.....
149 PSI AND BELOW															
Van Iderstine Co	Long Island City, N. Y	1948	145	Sat	.....	.....	.....	.....	1.0	327	SE	18	.....	.....	.....
General Foods Corp	Fulton, N. Y	7–47	140	Sat	1	16	Wi	UF(59)	.....	.....	.....	.....	.....	35	.....
General Foods Corp	Marion, Ind	9–47	140	Sat	1	36	CE	SS(122)	.....	.....	.....	.....	.....	76	.....
Nuodex Prod Co, Inc	Elizabeth, N. J	12–47	135	358	2	8	CB	O	.....	.....	.....	.....	.....	.....	.....
American Tobacco Co	Louisville, Ky	8–48	125	353	2	80	CE	SS(192)	.....	.....	.....	.....	.....	.....	.....
American Tobacco Co	Richmond, Va	7–48	125	353	1	17.5	BW	UF(72)	.....	.....	.....	.....	.....	56.9	.....
					1	21.9	BW	UF(72)							
					1	17.5	BW	O							
Canadair Co	Montreal, Que	12–49	125	340	1	22	CV	UF	.....	.....	.....	.....	.....	.....	.....
					1	32	CV	UF							
Clark Equip Co	Jackson, Mich		125	353	1	21	Wi	UF(97)	.....	.....	.....	.....	.....	42	.....
Danish Creamery Assn	Fresno, Calif	1948	125	Sat	1	17	.....	G	.....	.....	.....	.....	.....	.....	.....
Duplan Corp	Hazleton, Pa	1946	125	353	1	20	CE	TG(131)	.....	.....	.....	.....	.....	.....	.....
Dyersburg Cotton Prod	Dyersburg, Tenn	8–49	125	Sat	1	30	CE	SS(109)	.....	.....	.....	.....	.....	50	.....
B D Eisendrath Tanning Co	Racine, Wis	1–48	125	Sat	..	31.5	CE	SS(80)	.....	.....	.....	.....	.....	56.5	.....
Florida Agric & Mech College	Tallahassee, Fla	8–48	125	353	3	22	BW	O	.....	.....	.....	.....	.....	.....	.....

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BL —Black liquor
BW —Babcock & Wilcox Co
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HF —Hogged fuel
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JI —John Inglis Co, Ltd
Ke —E Keeler Co
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W —Wood
WH—Waste Heat
WB —Wm Bros Boiler & Mfg Co
WE —Westinghouse Electric Corp
Wi —Wickes Boiler Co
Wo —Worthington Pump & Machy Corp
WW—Wood waste
(150)—Stoker grate area, sq ft

Industrials and Institutionals: Below 200 Psi

For notes on uses and limitations of this tabulation • See this page

Compiled by J C McCabe, Associate Editor

Company	Location	First Operation, New Units	Nominal Pressure, psi	Nominal Steam Temperature, F	BOILERS				TURBINES					Total Boiler Capacity Incl New Units, 1000 lb	Total Generator Capacity Incl New Units, 1000 kw
					Number	Capacity, each 1000 lb per hr	Manufacturer	Firing	Capacity, 1000 kw	Speed, rpm	Manufacturer	Backpressure, psia	No. of Bleed Points		
Gunnison Homes	New Albany, Ind		125	Sat	2	10	KB	O						230	2.75
Holly Sugar Corp	Torrington, Wyo		125	Sat	4	10	BW								
Intern'tl Business Mach Co	Poughkeepsie, N. Y		125	353	2	17	CB	O						54	
Jeffrey Mfg Co	Columbus, Ohio	8–49	125	Sat	3	60	Wi	SS(114)						180	
Johns-Manville Corp	Tilton, N. H	10–47	125	Sat	1	10	BW	O							
Lake View Sanatorium	Menodota, Wis		125	Sat	2	7	KB	UF							
Long Island College Hospital	Brooklyn, N. Y	9–49	125	Sat					0.2	200	SE	20			
Mohn Bros. Co	Reading, Pa	8–49	125	Sat	1	21.5	BW	UF(60)						38.5	
Palmer Asbestos & Rubber	St. Mathews, Ky		125	Sat	1	14	Vo	SS							
San Francisco Brewing Co	San Francisco, Calif	1948	125	Sat	2	10	PB	G							
		1949	125	Sat	1	17		G							
Simmons Co	Elizabeth, N. J		125	405	2	35	EM	TG							
Sloane-Blabon Corp	Trenton, N. J	9–49	125	344	1	90	CE	TG						210	
U S Naval Training School	Great Lakes, Ill		125	Sat	3	10	KB	UF							
University of Manitoba	Fort Garry, Manitoba		125	430	1	50	FW	SS(196)						84	
General Foods Corp	Hoboken, N. J	1–48	120	Sat	1	60	BW	O						135	
Our Lady's Victory	Lackawanna, N. Y	3–48	115	Sat	3	16	KB	UF							
Xavier Hospital	Dubuque, Iowa	3–49	115	340	2	20	BW	TG							
Veterans Administration	Chillicothe, Ohio	1–49	110		3	35	BW	UF(88)						140	
					2	35	MI	UF							
City Auto Stamping Co	Toledo, Ohio	8–48	100	Sat	2	15	KB	UF						45	
			100	Sat	1	15	UI	UF							
Chrysler Corp	Newark, Delaware	1947	100	Sat	3	14	CB	O							
Clark Equipment Co	Jackson, Mich	8–49	100	Sat	2	30	RS	SS							
Ford Motor Co	Ypsilanti, Mich	12–48	100	Sat	2	20	Wi	O							
General Electric Co	Allentown, Pa	1949	100	338	1	3	HB	O							
Homer Laughlin China Co	Newell, W. Va		100	Sat	7	10	Wi	C							
Hooven & Allison Co	Xenia, Ohio		100	240	1	18	BW	UF							
Kutztown State Tchrs College	Kutztown, Pa	4–49	100	Sat	3	15	Ke	TG(75)							
Maensons Contracting Engrs	Los Alamos, N. M		100	Sat	2	30	Vo	O, G							
Northern State Hospital	Enid, Okla		100	Sat	2	30	Vo	O, G							
Dr Pepper Co	Dallas, Texas		100	Sat	2	10	KB	G							
Reading Hospital	Reading, Pa	1948	100	365	1	18	EC	TG(92)						42	
Rohm & Haas Co	Houston, Texas	4–48	100	338	2	17.5	CB	G							
St. Bonaventure College	Alleghany, N. Y	9–49	100	Sat	1	14	EC	C							
South Boston Housing	Boston, Mass	6–49	100	Sat	4	15	Bi	O							
Swift & Co	Champaign, Ill		100	Sat	1	11	CE	SS(140)							
U S Government		1949	100	338	16	3	HB	CA							
Wayne Works	Richmond, Ind		100	Sat	1	30	BW	TG							
American Stove Co	St. Louis, Mo	6–47			2	10	KB	G							
Baha'i Temple	Wilmette, Ill	1–48			3	6	KB	O							
Cadillac Motor Car Bldg	Chicago, Ill	6–47			2	8	KB	O							
General Petroleum Corp	Los Angeles, Cal				4	18	BB	O, G							
Gunnison Homes	New Albany, Ind	6–47			2	7	KB	O							
Hibbard, Spencer, Bartlett	Evanston, Ill	6–48			2	10	KB	O							
Northwestern Univ Apts	Evanston, Ill	6–47			3	8	KB	O							
Reading Batteries, Inc	South Temple, Pa	12–48			1	3	Ti	G							

AC —Allis-Chalmers Mfg Co
BB —Birchfield Boilers, Inc
Bi —Bigelow Co
BL —Black liquor
BW —Babcock & Wilcox Co
BWG—Babcock-Wilcox & Goldie-McCulloch Ltd
C —Coal, bituminous
CA —Coal, anthracite
CB —Cleaver-Brooks Co
CE —Combustion Engineering-Superheater Inc
CV —Canadian Vickers, Ltd
D —Damper
DBr —Dominion Bridge Co
DL —DeLaval Steam Turbine Co
Do —Duplex pump
EC —Erie City Iron Works
El —Elliott Co
EM —Edge Moor Iron Works, Inc
FW —Foster Wheeler Corp
G —Gas
GE —General Electric Co
HB —Heaman Boiler Works
HF —Hogged fuel
Hy —Hydraulic coupling
JI —John Inglis Co, Ltd
Ke —E Keeler Co
KB —Kewanee Boiler Corp
MI —Murray Iron Works Co
O —Oil
P —Pulverized-fuel firing
PB —Pacific Steel Boilers Corp
R —Regulator
RS —Riley Stoker Corp
S —Speed control
SE —Skinner Engine Co
SS —Spreader stoker
T —Turbine drive
TG —Traveling-grate stoker
Ts —Titusville Iron Works Div
UF —Underfeed stoker
Ui —Union Iron Works
V —Vane control
VK —Vickers Keeler Co
Vo —Henry Vogt Machine Co
W —Wood
WH —Waste Heat
WB —Wm Bros Boiler & Mfg Co
WE —Westinghouse Electric Corp
Wi —Wickes Boiler Co
Wo —Worthington Pump & Machy Corp
WW—Wood waste
(150)—Stoker grate area, sq ft

General Notes on Design-Survey Tabulations

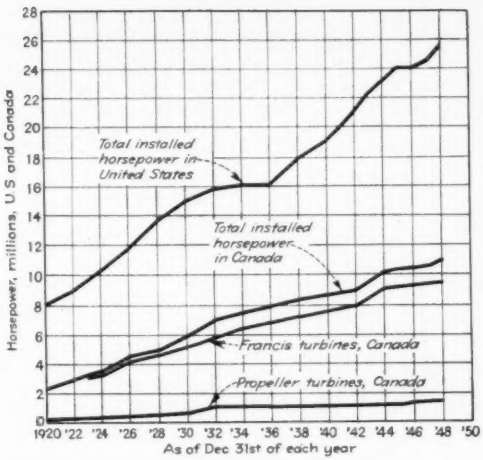
Knowing how the information in these tables is compiled helps to make clear their uses and limitations.

As a continuing operation, POWER's editors assemble news of installations being planned and equipment being ordered. From these records, questionnaires are mailed to the individual companies, asking for details of their projects. The replies form the basis for the tables, which are compiled at approximately yearly intervals.

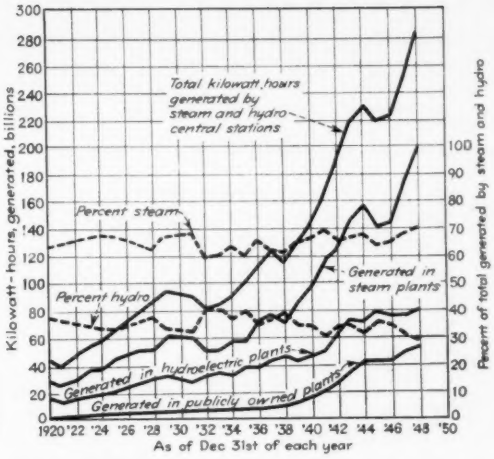
It can be seen that, in the nature of things, these tabulations cannot be complete. Nor can the published list correspond exactly in point of time with actual installations or announcements of them. Where engineering is done a long time ahead of construction, data may appear in the tables well before the start of plant construction.

On the other hand, many publicly announced installations do not appear until long after the fact is widely known, when engineering has gone ahead sufficiently to allow the owner to supply full technical information. In such cases, the matter is followed and when the data become available they are listed. Each set of tables is checked against preceding ones to avoid duplication.

Thus, while each listing represents the most complete data available anywhere, and is representative of design and construction work in progress at that time, it does not include *all* current programs, nor does it consist entirely of strictly current construction.


Horsepower, millions, U S and Canada
Total installed horsepower in United States
Total installed horsepower in Canada
Francis turbines, Canada
Propeller turbines, Canada
As of Dec 31st of each year

INSTALLED CAPACITY. Total hydroelectric power that was installed in the U. S. and Canada during the last 28 years. In the U. S. over 1,000,000 hp was installed in the year 1948


Kilowatt-hours, generated, billions
Percent of total generated by steam and hydro
Total kilowatt-hours generated by steam and hydro central stations
Percent steam
Percent hydro
Generated in steam plants
Generated in hydroelectric plants
Generated in publicly owned plants
As of Dec 31st of each year

POWER GENERATION. Power generated in U. S. steam and hydro central stations, the kilowatt-hours supplied by each class of plant and the percent of the total supplied by each

Hydro Booms in U. S. and Canada

► WATERPOWER DEVELOPMENT in the U. S. began to hit its stride in 1948, with over 1,000,000 hp going into operation. This raises the total to 25,500,000 hp. The significance of the new capacity figure is apparent when compared with 15,000 hp in 1946 and 500,000 in 1947. At the end of the war very little hydroelectric capacity was under construction. It required from then until the beginning of 1948 to get a large volume installed and ready for service.

New Plants. On pages 98 to 101 are recorded data on 115 new hydroelectric plants (1) which went into service (2) to which capacity was added in 1948 and (3) which are now under construction. These projects represent nearly 7,000,000 hp of capacity that will go into operation this year or that are on order to be installed by 1953.

Power-generating equipment, which is being installed or is on order for the plants of Grand Coulee, McNary, Hungry Horse, Davis and Hoover Dams, totals nearly 3,000,000 hp. This accounts for over 40% of all capacity on order, and indicates the major factor that governmental agencies, mostly federal, have become in waterpower development.

The table on page 104 further emphasizes this point. It lists 82 projects that have been built or are being constructed by governmental agencies other than municipal. These represent a total plant capacity of 17,104,425 hp, of which 7,725,000 hp have been installed and 5,436,970 hp are on order. That is, over 13,000,000 hp have been installed or are on order. This is equal to all the hydroelectric plant capacity installed in the U. S. at the end of 1927.

Power Generation. Because 1948 was in general a poor water year, power generation in hydro plants was less than 81-billion kwhr only, about a billion above 1945. With large blocks of hydroelectric capacity coming into service, power generation in the plants should soon rise sharply. A subnormal water supply, combined with a sharp rise in total power generation in 1948, reduced the percent supplied by hydro to about 29%. This is the lowest in over 30 years, Fig. 2. For the same reasons, steam generation was the highest, over 70%.

TVA continues to be the largest power-generating system in the world with an output of 14.25-billion kwhr, for the year ending June 30, 1948. For the same period Bonneville and Grand Coulee plant output on the Bonneville Power Administrations system was nearly 11-billion kwhr, of which nearly 7 billion was generated in Grand Coulee plant.

Canada Hydro. As in the U. S., hydro continues to boom in Canada. The table on pages 102 and 103 lists 54 projects that went into operation or were under construction in 1948. During this period over 400,000 hp went into service, bringing the total up to 10,870,000, Fig. 1. For the projects listed in the table, 1,780,000 hp are on order for service this year or later.

Among the large projects under construction are: Des Joachims of the Hydro-Electric Power Commission of Ontario, on the Ottawa River, where 500,000 hp are being installed. Beauharnois plant of the Quebec Hydro-Electric Commission is being extended for 636,000 hp of which one-half is on order. Trenche plant of the Shawinigan Water and Power Co is under construction for 390,000 hp of which 325,000 hp are on order. In British Columbia three 62,000-hp, of ten ultimate units, have been put into operation in the Bridge River plant of the Bridge River Power Corp.

Because rainfall was subnormal during the summer and fall of last year, power generation fell to 44.51-billion kwhr compared to nearly 45-billion in 1947. Of this amount, the Hydro-Electric Power Commission of Ontario generated or purchased 13.55-billion kwhr, about 33%. This power system is next to the largest in the world, being a close second to the Tennessee Valley Authority, which generated 14.25-billion kwhr last year.

United States Hydroelectric Plants Put in

Compiled by F A Annett, *Associate Editor*

Company or government agency	Design or consulting engineers	Project name	[1]New or redeveloped	River	State	Project started, date	[2]Dam type	Crest length, ft	Max height, ft	Date of initial operation	Initial capacity, hp
NEW ENGLAND STATES											
Central Maine Power Co		Union	Red.		Me.	1946				1948	23,200
Bangor Hydro-Electric Co	Bangor Hydro-Electric Co	Milford No. 4A	Red.	Penobscot	Me.	1948				1949	2,600
Great Northern Paper Co		Millinocket			Me.	1947				1948	8,832
American Woolen Mills		Brown Mills			Me.	1948				1949	
Bellows Falls Hydro-Elec Corp	Chas T Main, Inc	Wilder	Red.	Connecticut	N.H.&Vt.	1947	CG		59	1948	48,000
Village of Barton		Barton	New		Vt.	1947				1948	950
Ryegate Paper Co		East Ryegate	Red.		Vt.	1947				1948	438
Lyndonville Electric Dept	Chas T Main, Inc	Vail	Red.	Passumpsic	Vt.	1949				1949	530
Metropolitan District Comm	Metropolitan District Comm	Oakdale	New	Swift & Ware	Mass.	1947				1949	5,225
Ames Worsted Co		Upper	Red.		Mass.	1947				1948	515
Ames Worsted Co		Lower	Red.		Mass.	1947				1948	540
Holyoke Water Power Co			Red.		Mass.	1947				1948	450
L S Starrett Co		Athol	Red.		Mass.	1947				1948	280
MIDDLE ATLANTIC STATES											
New York Power & Light Corp		Steward Bridge	Red.		N. Y.	1947				1950	42,500
Eastern New York Power Co	W P Creager & Fargo Engrg Co	High Falls	New	Saranac	N. Y.	1947	CG	261	70	1948	12,800
Central Hudson Gas & Elec Corp	Chas T Main, Inc	Neversink	New	Neversink	N. Y.	1948	EF	2,800	200	1952	41,000
Allen V Smith, Inc		Marcellus Falls	Red.		N. Y.	1947				1948	330
International Paper Co		York Haven	Red.		Pa.	1948				1949	4,536
Beaver Falls Municipal Authority		Bently			Pa.	1947				1948	330
EAST NORTH CENTRAL STATES											
Ohio Public Service Co		Burger	New		Ohio	1948				1948	1,870
North Counties Hydro-Electric		Dayton	Red.		Ill.	1947				1948	1,350
The Lehon Co		Wilmington			Ill.	1947				1948	776
Consumers Power Co		Webber Dam			Mich.	1947				1948	1,430
U. S. Corps of Engineers	U. S. Corps of Engineers; Erik Floor & Associates	St. Mary's Falls	New	St. Mary's	Mich.	1947				1951	23,925
Wolverine Power Corp		Secord	New		Mich.	1947				1948	2,100
Presque Isle Elec Cooperative		Tower	New		Mich.	1947				1948	1,800
Dairyland Power Cooperative		Dairyland Dam	New		Wis.	1948				1950	25,800
Northern States Power Co	Pioneer Service & Engr Co	Holcombe	New	Chippewa	Wis.	1948	CG	462	68	1950	48,000
Wisconsin River Power Co	Harza Engineering Co	Petenwell	New	Wisconsin	Wis.	1947	CG		52	1949	28,800
Wisconsin River Power Co	Harza Engineering Co	Castle Rock	New	Wisconsin	Wis.	1948	CG		38	1950	22,000
Wisconsin Michigan Power Co	Mead & Hunt	Big Quinnesec Falls	New	Menominee	Wis.	1948	CG	640	72	1949	22,000
Wisconsin Michigan Power Co	Mead & Hunt	Way Dam	New	Michigamme	Wis.	1948				1948	2,500
City of Kaukauna Elec & Wtr Dept	Mead, Ward & Hunt	Little Chute	New		Wis.	1946				1948	4,980
Northern Wisconsin Power Co	Loeb & Eames	Orienta Falls	Red.	Iron	Wis.	1947	CG	267	54	1948	1,150
Oconto Electric Cooperative	Orbison & Orbison	Stiles	Red.	Oconto	Wis.	1947	Earth	2,000	29	1948	1,500
Marinette Paper Co		Marinette			Wis.	1947				1948	332
WEST NORTH CENTRAL STATES											
Minnesota Power & Light Co	Ebasco Services, Inc	Thomson	New	St. Louis	Minn.	1907	CG&EF			1910	39,000
Northwest Paper Co	Hazlett & Erdal	Cloquet	Red.	St. Louis	Minn.	1948	CG	190	40	1949	4,887
Blanden Paper			New		Minn.	1948				1950	1,900
U. S. Corps of Engineers	U. S. Corps of Engrs; Chas T Main	Garrison	New	Missouri	N. D.	1947	EE	12,000	210	1955	176,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Erik Floor & Associates	Fort Randall	New	Missouri	S. D.	1946	EE	10,000	160	1954	230,000
SOUTH ATLANTIC STATES											
Consumers Public Power Dist		Spencer	Red.	Niobrara	Neb.	1947				1949	3,040
Black Hills Power & Light Co		Belle Fourche	Red.		S. D.	1947				1948	500
The Tredegar Co		Richmond	New		Va.	1947				1948	383
U. S. Corps of Engineers	U. S. Corps of Engineers; Charles T. Main, Inc	Buzzs Island	New	Roanoke	Va.&N.C.	1947	CG	22,357	141	1952	175,200
U. S. Corps of Engineers	U. S. Corps of Engineers	Philpott	New	Smith	Va.	1948	CG	920	220	1951	19,640
Carolina Aluminum Co	Aluminum Company of America	Cheoah	New	Little Tenn.	N. C.	1916	CA	750	221	1919	112,000
Nantahala Power & Light Co	Aluminum Company of America	Queens Creek	New	Queens Creek	N. C.	1947	RFEF	328	76	1949	2,250
South Carolina Pub Service Auth		Santee Spillway	New	Santee	S. C.	1947				1949	2,720
U. S. Corps of Engineers	U. S. Corps of Engrs; Chas T Main	Clark Hill	New	Savannah	S.C.&Ga.	1947	CG	5,660	200	1953	385,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Sanderson & Porter	Allatoona	New	Etowah	Ga.	1946	CG	1,325	210	1949	102,900
U. S. Corps of Engineers	U. S. Corps of Engineers	Jim Woodruff	New	Chattahoochee	Fla.	1949	CG&EF	6,084	107	1953	42,000
EAST SOUTH CENTRAL STATES											
Alabama Power Co	Dixie Construction Co	Mitchell Dam	New	Coosa	Ala.	1921	CG	1,110	106	1923	72,000
Alabama Electric Cooperative		Andalusia	New		Ala.	1927				1948	2,960
Tennessee Valley Authority	U. S. Corps of Engineers; Hugh L Cooper & Co	Wilson, also Muscle Shoals	New	Tennessee	Ala.	1918	CGG	4,500	95	1926	260,000
Tennessee Valley Authority	Tennessee Valley Authority	Wheeler	New	Tennessee	Ala.	1933	CGG	6,335	68	1936	90,000
Tennessee Valley Authority	Tennessee Valley Authority	Fort Loudoun	New	Tennessee	Tenn.	1940	CGG	4,196	122	1943	88,000
Tennessee Valley Authority	Tennessee Valley Authority	Douglas	New	French Broad	Tenn.	1942	C&EF	1,705	202	1943	83,000
Tennessee Valley Authority	Tennessee Valley Authority	South Holston	New	South Holston	Tenn.	1942	R&E	1,550	290	1950	49,500
Tennessee Valley Authority	Tennessee Valley Authority	Watauga	New	Watauga	Tenn.	1942	R&E	900	318	1949	64,000
Tennessee Valley Authority	Tennessee Valley Authority	Wilbur	New	Watauga	Tenn.	1948	CG	380	77	1950	5,640
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Dale Hollow	New	Obey	Tenn.	1942	CG	1,717	185	1948	50,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Center Hill	New	Carney Fork	Tenn.	1942	C&E	2,160	240	1952	189,525
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Wolf Creek	New	Cumberland	Ky.	1942	C&E	5,736	240	1952	377,000

U. S. Waterpower Tables

[1]The term "New" applies to an entirely new project on a site that has not been developed before. "Redeveloped" indicates a project on a site that has been developed before and now has new wheels, settings and generators, or a new plant.

[2]CG, concrete gravity; CA, concrete arch; C&E, concrete and earth; CG & EF, concrete gravity and earth fill; CGG, concrete gravity with gates; EF, earth fill; RFEF, rock fill with earth face; R&E rock and earth fill; HEF, hydraulic earth fill; RFTC, rock-filled timber crib.

[3]AC —Allis-Chalmers Mfg Co
BL —Baldwin Locomotive Works
IM —I P Morris
JL —James Leffel & Co
MS —S Morgan Smith Co
NN —Newport News Shipbuilding & Dry Dock Co

Operation or Under Construction in 1948

Added cap No. of units	Date of added cap	Ultimate capacity, hp	No. of units installed	Waterwheel capacity, hp	Waterwheel, type	Speed, rpm	Static head, ft	Design head, ft	[1]Waterwheel manufacturer	[2]Governor manufacturer	Scroll case, concrete or steel	Penstock valve, type	Generator capacity, kva	Synchronising automatic or manual	[3]Thrust-bearing location	Design power factor	Kilovolts	Cycles	[4]Generator manufacturer
.....	.....	23,200	2	11,600	Kaplan	225	76	76	MS	W	Concrete	Head gt	12,000	Manual	AG	0.70	6.9	60	GE
.....	.....	2,600	1	2,600	Kaplan	120	20	20	MS	W	Concrete	Head gt	2,000	Automatic	AG	0.80	4.16	60	GE
.....	.....	8,832	6	1472	Francis	240	24	24	MS	....	Drives pulp grinders								
.....	.....	.....	1	695	Francis	164	22	22	AC	....	Closed flume	Head gt	563	Manual	AG	0.80	2.4	60	GE
.....	.....	48,000	2	24,000	Kaplan	125	53	49	MS	W	Concrete	Head gt	18,000	Manual	BG	0.90	13.8	60	AC
.....	.....	950	1	950	Francis	360	74	74	.....	W	Concrete	Head gt	870	Manual	AG	0.80	2.4	60	GE
.....	.....	438	1	438	Francis	86	13	13	JL	....	Concrete	Head gt	Drives mill machinery						
.....	.....	530	1	530	Kaplan	240	18	18	MS	W	Concrete	Head gt	438	Automatic	AG	0.80	2.4	60	GE
.....	.....	5,225	1	5,225	Francis	327	178–100	107	MS	W	Plate st	Dow disk	4,375	Auto. & man.	BG	0.90	13.8	60	GE
.....	.....	515	1	515	Francis	150	18	18	JL	W	Concrete	Head gt	438	Manual	AG	0.80	2.3	60	EM
.....	.....	540	1	540	Francis	182	20.5	20.5	JL	W	Concrete	Head gt	438	Manual	AG	0.80	2.3	60	EM
.....	.....	450	1	450	Francis	200	18.5	18.5	JL	....	Concrete	Head gt	Connects to existing generator						
.....	.....	280	1	280	Francis	200	17	17	JL	....	Concrete	Head gt	Connects to existing generator						
.....	.....	42,500	1	42,500	Francis	105.9	97	97	BL	....	.....	.....	37,500	.....	BG	0.80	13.8	60	GE
.....	.....	12,800	2	6,400	Francis	514	.....	270	JL	W	Steel	Gate	5,000	Manual	AG	0.80	6.9	60	EC
.....	.....	41,000	1	41,000	Francis	300	551–463	474	NN	W	Cast st	Butterfly	31,250	Manual	AG	0.80	13.8	60	GE
.....	.....	330	1	330	Francis	320	35	35	JL	....	.....	.....	Drives mill machinery						
.....	.....	4,536	1	756	Francis	163.6	20	20	MS	....	.....	Head gt	Connects to existing GE generator						
.....	.....	330	1	140	Francis	230	11	11	MS	....	Concrete	Head gt	Drives De Laval centrifugal pump						
.....	.....	.....	1	190	Francis	230	14	14	MS	....	Concrete	Head gt	Drives De Laval centrifugal pump						
1	1949	2,805	1	935	Francis	165–260	20–40	20–40	MS	....	Concrete	Head gt	Drives Worthington centrifugal pump						
.....	.....	1,350	1	1,350	Propeller	257	30	30	MS	....	Concrete	Head gt	Connects to existing generator						
.....	.....	776	2	388	Francis	83	12	12	JL	....	.....	Head gt	Drives mill machinery						
.....	.....	1,430	1	1,430	Francis	200	27	27	JL	W	Concrete	Head gt	1,250	.....	AG	0.80	2.5	60	EM
.....	.....	72,750	3	6,975	Propeller	80	23–18	21	AC	W	Concrete	Head gt	5,333	Manual	BG	0.90	13.8	60	GE
.....	.....	.....	1	3,000	Kaplan	128.5	23–18	21	MS	W	Concrete	Head gt	2,500	Manual	BG	0.80	4.16	60	GE
.....	.....	2,100	1	2,100	.....	200	48	48	.....	W	Concrete	Head gt	1,500	Manual	AG	0.80	2.4	60	EM
.....	.....	1,800	2	900	Kaplan	150	42	42	MS	....	Concrete	Head gt	750	Manual	AG	0.80	2.4	60	WE
.....	.....	25,800	3	8,600	Kaplan	225	62	62	MS	....	Concrete	Head gt	6,250	Manual	BG	0.80	4.16	60	EC
.....	.....	48,000	3	16,000	Propeller	120	45–20	45	BL	W	Concrete	Head gt	12,500	Automatic	BG	0.90	6.9	60	WE
.....	.....	28,800	4	7,200	Kaplan	163.6	42	42	MS	W	Concrete	Head gt	6,250	Manual	AG	0.80	7.2	60	GE
.....	.....	22,000	5	4,400	Kaplan	150	28	28	MS	W	Concrete	Head gt	3,750	Manual	AG	0.80	4.16	60	AC
.....	.....	33,000	2	11,000	Francis	200	92–85	92	AC	W	Plate st	Head gt	8,889	Automatic	BG	0.90	6.9	60	AC
.....	.....	2,500	1	2,500	Propeller	225	38–25	35	AC	W	Concrete	Head gt	2,250	Manual	AG	0.80	4.16	60	AC
.....	.....	4,980	3	1,660	Kaplan	112.5	14	14	MS	W	Concrete	Head gt	1,375	Manual	AG	0.80	2.4	60	EM
.....	.....	1,150	1	1,150	Francis	277	55	55	JL	W	Plate st	Head gt	1,000	Manual	AG	1.00	2.4	60	EM
.....	.....	2,250	2	750	Kaplan	225	20	20	MS	W	Concrete	Head gt	625	Automatic	AG	0.80	2.4	60	AC
.....	.....	332	1	332	Francis	109	14	14	JL	....	.....	.....	Drives mill machinery						
2	1914–18	89,000	3	13,000	Francis	375	345–355	355	AC	IM	Plate st	Butterfly	11,250	Manual	AG	0.80	6.6	60	GE
1	1949	.....	2	15,000	Francis	375	345–355	355	IM	IM	Plate st	Butterfly	12,800	Manual	AG	0.80	6.6	60	GE
.....	.....	.....	1	20,000	Francis	400	345–355	355	MS	W	Plate st	Butterfly	15,000	Manual	AG	0.80	6.6	60	GE
1	1949	6,437	1	2,500	Kaplan	240	21	21	MS	W	Concrete	Head gt	2,250	Manual	AG	0.80	2.4	60	WE
.....	.....	1,900	1	1,900	Propeller	150	20	20	AC	....	Open flume	Head gt	1,875	Manual	AG	0.80	2.4	60	EM
.....	.....	140,000	2	88,000	Francis	90	187–160	100	.....	.....	Plate st	Head gt	84,200	Manual	BG	0.95	13.8	60	.....
.....	.....	460,000	4	57,500	Francis	.....	145–76	112	.....	.....	Plate st	Head gt	42,100	Manual	BG	0.95	13.8	60	.....
.....	.....	3,740	1	2,200	Kaplan	120	21	21	MS	W	Concrete	Head gt	2,000	Manual	AG	0.80	4.6	60	WE
.....	.....	.....	1	500	Francis	360	40	40	JL	....	.....	.....	Connects to existing Electric Machinery generator						
.....	.....	383	1	383	Francis	150	27	27	JL	....	Open flume	Head gt	Drives mill machinery						
.....	.....	.....	3	51,000	Francis	85.8	108–60	90	NN	W	Plate st	Head gt	35,555	Manual	BG	0.90	13.8	60	WE
.....	.....	328,200	1	19,000	Francis	138.5	108–60	90	BL	W	Plate st	Head gt	13,333	Manual	BG	0.90	13.8	60	WE
.....	.....	.....	2	1,600	Francis	450	108–60	90	JL	W	Service unit	.....	1,250	Manual	AG	0.80	0.48	60	.....
.....	.....	19,640	2	9,800	Francis	257	177–109	152	.....	.....	Plate st	Head gt	7,500	Manual	BG	0.90	13.8	60	.....
.....	.....	.....	1	840	Francis	900	177–109	152	.....	.....	Service unit	.....	750	Manual	AG	0.90	0.48	60	.....
1	1949	157,000	4	28,000	Francis	171.5	189	189	AC	AC	Plate st	Head gt	21,050	Manual	AG	0.95	13.8	60	AC
.....	.....	.....	1	45,000	Francis	164	189	189	AC	AC	Plate st	Head gt	37,500	Manual	AG	0.80	6.9	60	AC
.....	.....	2,250	1	2,250	Impulse	600	1000–925	969	MS	W	.....	Head gt	1,800	Manual	HS	0.90	2.4	60	EC
.....	.....	2,720	1	2,720	Francis	180	46	46	JL	W	Concrete	Head gt	2,500	.....	AG	0.80	2.4	60	GE
.....	.....	385,000	7	55,000	Francis	100	150–111	135	NN	AC	Plate st	Head gt	43,444	Manual	BG	0.90	13.8	60	.....
.....	.....	152,900	2	50,000	Francis	112.5	153–105	135	MS	W	Plate st	Head gt	40,000	Automatic	BG	0.90	13.8	60	WE
.....	.....	.....	1	2,900	Francis	450	153–105	135	JL	W	Service unit	.....	2,500	Manual	AG	0.80	2.4	60	WE
.....	.....	42,000	3	14,000	Kaplan	75	32–14	26.5	NN	....	Concrete	Head gt	11,111	Manual	BG	0.90	13.8	60	.....
1	1949	101,000	3	24,000	Francis	90	73–65	70	AC	AC	Concrete	Head gt	20,000	Manual	AG	0.87	6.6	60	GE
.....	.....	.....	1	29,000	Francis	90	73–65	70	AC	W	Concrete	Head gt	25,000	Manual	AG	0.87	6.6	60	GE
.....	.....	2,960	1	2,960	Francis	138.5	40	40	JL	W	Concrete	Head gt	2,500	Manual	AG	0.80	2.3	60	GE
.....	.....	.....	4	30,000	Francis	100	95	92	BL	BL	Concrete	Head gt	24,000	Manual	AG	0.90	13.8	60	WE
14	1926–43	610,000	4	35,000	Francis	100	95	92	NN	W&L	Concrete	Head gt	28,000	Manual	AG	0.90	13.8	60	GE
4	1949–51	.....	6	35,000	Francis	100	95	92	AC	AC&W	Concrete	Head gt	28,000	Manual	AG	0.90	13.8	60	AC
.....	.....	.....	4	35,000	Francis	100	95	92	AC	W	Concrete	Head gt	28,000	Manual	AG	0.90	13.8	60	AC
5	1936–48	360,000	5	45,000	Propeller	85.7	54–43	48	BL	W	Concrete	Head gt	36,000	Manual	BG	0.90	13.8	60	GE
3	1949–50	.....	3	45,000	Propeller	85.7	54–43	48	BL	W	Concrete	Head gt	36,000	Manual	BG	0.90	13.8	60	GE
2	1948–49	176,000	2	44,000	Kaplan	105.8	78–60	65	BL	W	Concrete	Head gt	35,000	Manual	BG	0.90	13.8	60	AC
.....	.....	.....	2	44,000	Kaplan	105.8	78–60	65	BL	W	Concrete	Head gt	35,000	Manual	BG	0.90	13.8	60	AC
1	1948	157,000	2	41,500	Francis	94.7	129–97	100	MS	W	Concrete	Head gt	33,330	Manual	BG	0.90	13.8	60	GE
.....	.....	.....	1	35,500	Francis	90	95–47	100	MS	W	Concrete	Head gt	28,888	Manual	BG	0.90	13.8	60	GE
.....	.....	49,500	1	49,500	Francis	144	252–126	180	MS	W	Plate st	Head gt	28,888	Auto. & man.	BG	0.90	13.8	60	WE
.....	.....	69,000	2	34,500	Francis	200	325–165	216	NN	W	Welded pl st	Butterfly	27,777	Auto. & man.	BG	0.90	13.8	60	WE
1	1950	15,340	1	9,700	Francis	180	158	158	JL	W	Plate st	Head gt	7,777	Automatic	BG	0.90	2.3	60	EC
1	1952	75,000	2	25,000	Francis	163.6	118–154	140	MS	W	Plate st	Head gt	20,000	Manual	BG	0.90	13.8	60	WE
.....	.....	.....	1	25,000	Francis	163.6	118–154	140	MS	W	Plate st	Head gt	20,000	Manual	BG	0.90	13.8	60	WE
.....	.....	189,025	3	62,500	Francis	105.9	134–206	160	BL	W	Plate st	Head gt	50,000	Manual	BG	0.90	13.8	60	GE
.....	.....	.....	1	1,525	Francis	720	134–206	160	NN	W	Plate st	Head gt	1,000	Manual	AG	0.80	0.48	60	EC
.....	.....	377,000	6	62,500	Francis	105.9	111–214	160	BL	W	Plate st	Head gt	50,000	Manual	BG	0.90	13.8	60	GE
.....	.....	.....	1	2,000	Francis	600	111–214	160	.....	.....	Service unit	.....	1,500	Manual	AG	0.80	0.4	60	EC

PW —Pelton Water Wheel Co
W —Woodward Governor Co
L —Lombard Governor Co
EC —Elliott Co
EM —Electric Machinery Mfg Co

GE —General Electric Co
WE —Westinghouse Electric Corp

[3]AG indicates that the thrust bearing is above generator; BG, thrust bearing is below generator; HS, horizontal-shaft machine.

[5]Dam, tunnels and steel-pipe conduits are being designed and constructed by New York City Board of Water Supply as a part of the Delaware Water System.

[6]Units installed in 1923, rated 35,000 hp, have been rebuilt for 44,000 hp.

United States Hydroelectric Plants Put in

Company or government agency	Design or consulting engineers	Project name	New or redeveloped	River	State	Project started-date	Dam type	Crest length, ft	Max. height, ft	Date of initial operation	Initial capacity, hp
WEST CENTRAL STATES											
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Bull Shoals	New	White	Ark.	1947	CG	2,256	284	1953	150,000
U. S. Corps of Engineers	U. S. Corps of Engineers; L H Harza Engineering Co	Norfolk Dam	New	North Fork	Ark.	1940	CG	2,631	233	1944	42,540
U. S. Corps of Engineers	U. S. Corps of Engrs; Fargo Eng Co.	Narrows Dam	New	Little Missouri	Ark.	1947	CG	941	185	1950	24,000
U. S. Corps of Engineers	U. S. Corps of Engineers	Fort Gibson	New	Grand	Okla.	1946	CGE	2,850	110	1953	64,000
U. S. Corps of Engineers	U. S. Corps of Engineers	Tenkiller Ferry	New	Illinois	Okla.	1948	RE	3,000	155	1953	47,000
U. S. Corps of Engineers	U. S. Corps of Engineers	Dennison Dam	New	Red	Okla.& Texas	1939	EF	23,200	165	1945	58,080
U. S. Corps of Engineers	U. S. Corps of Engineers	Buchanan	New	Colorado	Texas	1936	MA	11,000	146	1938	34,000
Lower Colorado River Authority	Fargo Engineering Co & LCRA	Granite Shoals	New	Colorado	Texas	1949	CGEF	765	105	1952	66,000
Lower Colorado River Authority	Fargo Engineering Co	Marble Falls	New	Colorado	Texas	1949	CG	820	80	1952	42,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Ambursen Engineering Corp	Whitney Dam	New	Brazos	Texas	1946	CG& EF	17,801	163	1952	41,100
MOUNTAIN STATES											
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Hoover Dam	New	Colorado	Ariz.& Nev.	1931	GA	1,180	730	1936	515,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Davis Dam	New	Colorado	Ariz.& Nev.	1941	R&E	1,500	135	1950	311,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Estes Park	New	Big Thompson	Colo.	1947	.....	.....	.....	1950	63,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Mary's Lake	New	Big Thompson	Colo.	1947	.....	.....	.....	1950	11,300
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Kortes	New	North Platte	Wyo.	1946	CG	.....	230	1949	55,500
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Heart Mt.	New	Shoshone	Wyo.	1946	.....	.....	.....	1948	8,300
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Boysen	New	Big Horn	Wyo.	1947	EF	1,000	150	1950	21,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Anderson Ranch	New	Boise	Idaho	1941	EF	1,350	330	1950	37,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Hungry Horse	New	S.F. Flathead	Mont.	1948	CA	2,100	520	1952	420,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Harza Engineering Co	Fort Peck	New	Missouri	Mont	1934	HEF	21,000	250	1943	50,000
Montana Power Co	Ebasco Services, Inc	Kerr	New	Flathead	Mont.	1930	CA	385	200	1938	77,000
Idaho Power Co	Ebasco Services, Inc	Lower Salmon	New	Snake	Idaho	1946	CG	700	50	1949	95,800
Idaho Power Co	Ebasco Services, Inc	Bliss	New	Snake	Idaho	1947	CG	500	80	1949	99,600
Idaho Power Co	Ebasco Services, Inc	Upper Malad	New	Malad	Idaho	1946	.....	140	20	1948	12,000
Idaho Power Co	Ebasco Services, Inc	Lower Malad	New	Malad	Idaho	1946	.....	180	10	1948	22,000
Village of Bonners Ferry	J H Cave & H M Buroker	.....	New	.....	Idaho	1941	CA	200	90	1942	1,500
Western Colorado Power Co.	Utah Power & Light Co	Tacoma	New	Animas	Colo.	1903	RFTC	730	55	1906	6,000
Montana Power & Light Co	.....	Troy	New	.....	Mont.	1946	.....	.....	.....	1948	.....
Heber City Light & Power Co	.....	Spring Creek	New	.....	Utah	1948	.....	.....	.....	1949	.....
Springville Municipal Pr & Lt Sys.	.....	Bartholomew	New	.....	Utah	1948	.....	.....	.....	1949	755
PACIFIC COAST STATES											
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Grand Coulee	New	Columbia	Wash.	1934	CG	4,500	553	1941	538,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Yakama, Rosa Div.	New	Irr Canal	Wash.	1947	.....	.....	.....	1948	750
Pacific Power & Light Co	Ebasco Services, Inc	Merwin (was Ariel)	New	Lewis	Wash.	1929	Arch	752	314	1931	61,000
Petes Orielle Mines & Metals Co.	.....	Metaline Falls	New	.....	Wash.	1948	.....	.....	.....	1949	.....
City of Seattle Dept of Lighting	Dr J L Savage	Gorge	Red.	Skagit	Wash.	1948	CG	180	33	1951	92,500
U. S. Corps of Engineers	U. S. Corps of Engineers	McNary Dam	New	Columbia	Wash & Ore.	1947	CG&E	8,800	158	1954	450,200
U. S. Corps of Engineers	U. S. Corps of Engineers	Detroit	New	North Sanitam	Ore.	1947	CG	1,580	377	1953	140,000
Eugene Water Power Board	.....	Leaburg	New	McKenzie	Ore.	1927	Roller	330	20	1929	10,000
Eugene Water Power Board	Cornell, Howland, Hayes & Merryfield	Waterville	Red.	McKenzie	Ore.	1948	.....	.....	.....	1949	11,000
California-Oregon Power Co	Pioneer Service & Engrg Co	Toketee	New	North Umpqua	Ore.	1946	EF	500	75	1949	37,200
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Shasta	New	Sacramento	Calif.	1928	CG	3,500	560	1944	213,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Keswick	New	Sacramento	Calif.	1941	CG	1,050	120	1949	102,000
Pacific Gas & Electric Co	Pacific Gas & Electric Co	Rock Creek	New	N F Feather	Calif.	1947	CG	550	120	1950	147,000
Pacific Gas & Electric Co	Pacific Gas & Electric Co	Cresta	New	N F Feather	Calif.	1947	CG	367	103	1949	93,000
Pacific Gas & Electric Co	Pacific Gas & Electric Co	Colgate	Red.	N F Yuba	Calif.	1948	CG	175	41	1949	35,000
Pacific Gas & Electric Co	Pacific Gas & Electric Co	Electra	Red.	Mokelumne	Calif.	1947	Earth	640	120	1948	112,500
Pacific Gas & Electric Co	Pacific Gas & Electric Co	West Point	New	Mokelumne	Calif.	1947	CA	420	100	1948	17,000
Southern California Edison Co.	Stone & Webster Engrg Corp; Southern Calif. Edison Co	Big Creek No. 3	New	San Joaquin	Calif.	1921	CA	494	130	1923	105,000
Imperial Irrigation District	U. S. Bureau of Reclamation	Drop No. 4	New	A A Canal	Calif.	1937	None	.....	.....	1941	13,300
Dept of Water & Power, City of Los Angeles	F J Converse, Chas T Leeds, Chester Marlave, C R Rankin & Dept's Power System Engs	Owens Gorge No. 1	New	Owens	Calif.	1948	.....	.....	.....	1950	153,600
		Owens Gorge No. 2									
		Owens Gorge No. 3									
City of Pasadena Water Dept.	Morris S Jones	Azusa	Red.	San Gabriel	Calif.	1947	.....	.....	.....	1949	3,400

U. S. Waterpower Tables

The term "New" applies to an entirely new project on a site that has not been developed before. "Redeveloped" indicates a project on a site that has been developed before and now has new wheels, settings and generators, or a new plant.

CG, concrete gravity; CA, concrete arch; C&E, concrete and earth; CG & EF, concrete gravity and earth fill; CGG, concrete gravity with gates; EF, earth fill; RFEF, rock fill with earth face; R&E, rock and earth fill; HEF, hydraulic earth fill; RFTC, rock-filled timber crib.

AC — Allis-Chalmers Mfg Co
BL — Baldwin Locomotive Works
LM — S P Morris
JL — James Leffel & Co
MS — S Morgan Smith Co
NN — Newport News Shipbuilding & Dry Dock Co

Operation or Under Construction in 1948

Added cap. No. of units	Date of added cap.	Ultimate capacity, hp	No. of units installed	Waterwheel capacity, hp	Waterwheel, type	Speed, rpm	Static head, ft	Design head, ft	Waterwheel manufacturer	Governor manufacturer	Scroll case, concrete or steel	Penstock valve, type	Generator capacity, kva	Synchronizing automatic or manual	Thrust-bearing location	Design power factor	Kilovolts	Cycles	Generator Manufacturer
.....	.....	214,000	3	52,000	Francis	128.6	239–132	190	AC	.....	Welded pl st	Head gt	42,100	Manual	BC	0.95	13.8	60	AC
			2	1,500	Francis	600	239–132	190	JL		Service unit	.....	1,250	Manual	AG	0.80	0.48	60	GE
			1	42,000	Francis	128.5	202–132	160	MS	W	Plate st	Head gt	38,890	Manual	BG	0.90	13.8	60	WE
1	1949	168,540	1	540	Francis	750	202–132	160	JL	W	Service unit	.....	500	Manual	AG	0.80	0.48	60	WE
			1	42,000	Francis	128.5	202–132	160	MS	W	Plate st	Head gt	38,890	Manual	BG	0.90	13.8	60	WE
.....	.....	36,000	2	12,000	Francis	225	154–68	132	BL	W	Plate st	Head gt	9,444	Manual	BG	0.90	13.8	60	EC
.....	.....	96,000	4	16,000	Francis	100	90–56	61	BL	W	Concrete	Head gt	12,500	Auto. & man.	BG	0.90	13.8	60	AC
.....	.....	47,000	2	23,500	Francis	150	181–104	132	NN		Plate st	Butterfly	18,000	Manual	BG	0.95	13.8	60	
			1	76,000	Francis	90	131–75	103	MS	W	Plate st	Head gt	36,842	Manual	BG	0.95	13.8	60	WE
1	1949	283,000	2	1,040	Francis	.....	131–75	103	JL	W	Service unit	.....	750	Manual	AG	0.80	0.48	60	WE
			1	56,000	Francis	90	131–7	103	MS	W	Plate st	Head gt	36,842	Manual	BG	0.95	13.8	60	WE
1	1949	51,900	2	17,300	Francis	171.4	133–73	115	NN	W	Plate st	Head gt	12,500	Manual	BG	0.90	6.9	60	WE
			1	17,300	Francis	171.4	133–73	115	BL	W	Plate st	Head gt	12,500	Manual	BG	0.90	6.9	60	WE
.....	.....	66,000	2	33,000	Francis	100	83	83	BL	W	Plate st	Head gt	25,000	Auto. & man.	BG	0.90	13.8	60	GE
.....	.....	42,000	2	21,000	Propeller	120	57	7	MS	W	Concrete	Head gt	16,666	Auto. & man.	BG	0.90	6.9	60	WE
.....	.....	41,400	2	20,700	Francis	128.5	126–78	91.5	NN	W	Plate st	Head gt	16,667	Manual	BG	0.90	13.8	60	AC
			9	115,000	Francis	180	584–422	520	7 AC 2 PW	W W	Cast st	Butterfly	82,500	Auto. & man.	AG	1.00	16.5	60	4 WE 5 GE
			1	55,000	Francis	237	.....	520	NN	W	Cast st	Butterfly	40,000	Auto. & man.	AG	1.00	13.8	60	AC
2	1951	1,835,000	2	3,500	Impulse	300	.....	520	PW	W	House unit	.....	3,000	Manual	HS	0.80	2.4	60	EM
			3	115,000	Francis	180	.....	520	BL	W	Cast st	Butterfly	82,500	Auto. & man.	AG	1.00	16.5	[6]GE, 2WE	
			2	115,000	Francis	180	584–422	520	AC	W	Welded pl st	Butterfly	82,500	Auto. & man.	AG	1.00	16.5	60	AC
.....	.....	3 1,000	5	62,500	Francis	94 7	147–100	127	BL	W	Plate st	Head gt	45,000	Auto. & man.	AG	1.00	13.8	60	GE
.....	.....	63,000	3	21,000	Francis	400	563–550	555	AC	W	Plate st	Butterfly	16,667	Auto. & man.	AG	0.90	6.9	60	GE
.....	.....	11,300	1	11,300	Francis	327	217–207	212	NN	W	Plate st	Automatic	9,000	Automatic	AG	0.90	6.9	60	GE
.....	.....	55,500	3	18,500	Francis	240	209–158	200	AC	AC	Plate st	Ring	13,333	Auto. & man.	AG	0.90	6.9	60	EC
.....	.....	8,300	1	8,300	Francis	450	277	265	MS	W	Plate st	Head gt	6,000	Auto. & man.	AG	0.80	2.4	60	EC
.....	.....	21,000	2	10,500	Francis	180	112–70	96	NN	W	.....	.....	7,500	Manual	AG	1.00	6.9	60	WE
.....	.....	55,500	2	18,500	Francis	277	330–173	260	JL	W	Cast st	Butterfly	15,000	Manual	AG	1.00	6.9	60	WE
.....	.....	420,000	4	105,000	Francis	189	485–262	400	AC	W	Welded pl st	Head gt	75,000	Auto. & man.	AG	1.00	6.9	60	GE
			1	50,000	Franci	128.5	205–120	170	MS	W	Plate st	Butterfly	38,889	Manual	BG	0.90	13.8	60	AC
1	1947	150,000	1	20,000	Francis	164	205–120	170	MS	W	Plate st	Butterfly	16,667	Manual	BG	0.90	13.8	60	AC
1	1951		1	50,000	Francis	128.5	205–120	170	MS	W	Plate st	Butterfly	38,889	Manual	BG	0.90	13.8	60	AC
1	1948	154,000	1	77,000	Francis	112.5	191	189	NN	W	Plate st	Head gt	56,000	Manual	BG	0.90	13.8	60	WE
1			1	77,000	Francis	112.5	191	189	NN	W	Plate st	Head gt	56,000	Manual	BG	0.90	13.8	60	WE
.....	.....	95,800	3	21,000	Propeller	120	55.5	55.5	NN	W	Concrete	Head gt	19,800	Manual	AG	0.86	13.8	60	AC
			1	22,800	Kaplan	120	55.5	55.5	MS	W	Concrete	Head gt	19,800	Manual	AG	0.86	13.8	60	AC
.....	.....	132,100	2	32,500	Propeller	128.5	70	70	NN	W	Concrete	Head gt	25,000	Manual	BG	0.86	13.8	60	WE
			1	34,600	Kaplan	128.5	70	70	MS	W	Concrete	Head gt	25,000	Manual	BG	0.86	13.8	60	WE
.....	.....	12,000	1	12,000	Francis	225	124	124	AC	W	Plate st	Head gt	8,000	Automatic	AG	0.86	6.9	60	AC
.....	.....	22,000	1	22,000	Francis	208	157	157	AC	W	Plate st	Head gt	15,500	Automatic	AG	0.86	13.8	60	AC
1	1948	3,000	1	1,500	Francis	720	212	200	JL	W	Concrete	Head gt	1,250	Manual	AG	0.80	2.5	60	EM
			1	1,500	Francis	720	212	200	JL	W	Concrete	Head gt	1,250	Manual	AG	0.80	2.5	60	EM
1	1949	11,000	2	3,000	Impulse	300	1000	937	PW	I	.....	.....	2,250	Manual	HS	0.80	4.0	60	GE
			1	5,000	Impulse	327	1000	937	PW	W	.....	.....	4,375	Manual	HS	0.80	4.0	60	WE
.....	.....		1	5,280	Francis	360	150	150	MS	.....	Plate st	Head gt	4,375	Manual	AG	0.80	2.4	60	GE
.....	.....	1,030	1	1,030	Impulse	1200	.....	1480	.....	W	.....	.....	1,000	Manual	HS	0.80	2.4	60	GE
.....	.....	755	1	755	Impulse	1200	.....	890–1086	MS	W	.....	.....	625	Manual	HS	0.80	2.4	60	GE
		3,012,000	9	165,000	Francis	120	368	300	NN	W	Cast st	Head gt	120,000	Auto. & man.	AG	1.00	13.8	60	WE
9	1949-51		3	14,000	Francis	100	368	300	PW	W	Service unit	.....	10,000	Auto. & man.	AG	0.80	2.4	60	WE
			9	165,000	Francis	120	368	300	NN	W	Cast st	Head gt	120,000	Auto. & man.	AG	1.00	13.8	60	WE
.....	.....	750	2	375	Francis	1000	96	96	JL		Cast iron	Head gt	Drive Peerless centrifugal pumps						
			1	61,600	Francis	240	.....	190	MS	W	Plate st	Head gt	45,000	Manual	BG	0.80	13.8	60	WE
1	1948	252,400	1	1,050	Francis	.....	.....	190	JL	W	House unit	.....	1,250	Manual	AG	0.80	2.4	60	GE
			1	63,600	Francis	240	.....	190	MS	W	Plate st	Head gt	56,250	Manual	BG	0.80	13.8	60	WE
.....	.....		1	2,940	Propeller	180	30	30	MS	.....	Concrete	Head gt	2,250	Manual	AG	0.80	2.4	60	EM
.....	.....	92,500	1	92,500	Francis	164	375–240	335	AC	.....	Welded pl st	Butterfly	6,700	Manual	BG	0.90	11.0	60	WE
.....	.....	1,358,200	4	111,300	Kaplan	87.5	92–65	80	MS	.....	Concrete	Head gt	7,684	Manual	BG	0.95	13.8	60	GE
			1	5,000	.....	.....	92–65	.....	.....	.....	Concrete	Head gt	3,750	Manual	BG	0.80	4.16	60	GE
.....	.....	210,000	2	70,000	Francis	163.6	375–225	285	.....	.....	Plate st	Butterfly	55,555	Manual	BG	0.90	13.8	60	.....
1	1949	20,000	1	10,000	Francis	225	89–80	88	MS	MS	Concrete	Head gt	7,500	Manual	AG	1.00	11.5	60	WE
.....	.....		1	10,000	Francis	225	89–80	88	MS	W	Concrete	Head gt	9,375	Manual	AG	0. 0	11.5	60	AC
.....	.....	11,000	1	11,000	Kaplan	171 4	55	55	BL	W	Concrete	Head gt	9,412	Automatic	AG	0.85	11.5	60	GE
.....	.....	55,800	2	18,600	Francis	400	471	440	MS	W	Plate st	Butterfly	16,667	Automatic	AG	0.85	6.9	60	AC
			2	103,000	Francis	150	480–234	330	AC	AC	Plate st	Head gt	75,000	Auto. & man.	AG	1.00	13.8	60	GE
2	1948	522,000	1	3,500	Francis	600	480–234	330	JL	W	Cast st	Head gt	2,500	Auto. & man.	AG	0.80	2.4	60	GE
1	1949		2	103,000	Francis	150	480–234	330	AC	AC	Plate st	Head gt	75,000	Auto. & man.	AG	1.00	13.8	60	GE
			1	103,000	Francis	150	480–234	330	AC	AC	Plate st	Head gt	75,000	Auto. & man.	AG	1.00	13.8	60	GE
.....	.....	102,000	3	34,000	Francis	94.7	102–46	90	MS	W	Concrete	Head gt	25,000	Auto. & man.	AG	1.00	13.8	60	GE
.....	.....	147,000	3	73,500	Francis	240	535	481	NN	W	Plate st	Butterfly	63,000	Auto. & man.	AG	0.90	13.8	60	WE
.....	.....	93,000	2	46,500	Francis	180	290	254	PW	W	Plate st	Butterfly	37,500	Auto. & man.	AG	0.90	11.5	60	GE
.....	.....	35,000	1	35,000	Francis	450	852	728	PW	W	Plate st	Butterfly	30,000	Auto. & man.	AG	0.80	11.5	60	WE
.....	.....	112,500	3	37,500	Impulse	225	1268	1223	PW	W	None	Butterfly	33,000	Auto. & man.	HS	0.90	13.8	60	AC
.....	.....	17,000	1	17,000	Francis	300	320	312	AC	W	Plate st	Butterfly	16,000	Auto. & man.	AG	0.85	13.8	60	AC
1	1949	177,000	3	44,000[6]	Francis	428	830	760	PW	W	Cast st	Butterfly	33,000	Manual	AG	0.80	11.0	60	WE
			1	45,000	Francis	450	830	760	PW	W	Cast st	Butterfly	35,000	Manual	AG	0.80	12.5	60	WE
1	1950	28,300	1	13,300	Propeller	150	56–49	51	NN	W	Concrete	Head gt	12,000	Manual	AG	0.80	6.9	60	EC
			1	15,000	Kaplan	138.5	56–49	51	AC	W	Concrete	Head gt	12,500	Manual	AG	0.80	6.9	60	GE
.....	.....	153,600	1	51,200	Francis	400	820	743	PW	W	Cast st	.....	37,500	Automatic	AG	1.00	11.5	60	WE
			1	51,200	Francis	400	790	743	PW	W	Cast st	.....	37,500	Automatic	AG	1.00	11.5	60	WE
			1	51,200	Francis	400	790	743	PW	W	Cast st	.....	37,500	Automatic	AG	1.00	11.5	60	WE
.....	.....	3,400	1	3,400	Francis	720	.....	395	JL	W	Plate st	Head gt	3,000	Automatic	.....	1.00	2.4	60	AC

PW —Pelton Water Wheel Co
W —Woodward Governor Co
L —Lombard Governor Co.
EC —Elliott Co
EM —Electric Machinery Mfg Co

GE —General Electric Co
WE —Westinghouse Electric Corp

[4]AG indicates that the thrust bearing is above generator; BG, thrust bearing is below generator; HS, horizontal-shaft machine.

[5]Dam, tunnels and steel-pipe conduits are being designed and constructed by New York City Board of Water Supply as a part of the Delaware Water System.

[6]Units installed in 1923, rated 35,000 hp, have been rebuilt for 44,000 hp.

Canadian Hydroelectric Plants Put in

Compiled by F A Annett
Associate Editor

Company or government agency	Design or consulting engineers	Project name	New or redeveloped	River	Province	Project started, date	Dam type	Crest length, ft	Max height, ft	Date of initial operation	Initial capacity, hp
Avon River Power Co	Montreal Engineering Co	Methals	New	Methals	N.S.	1947	EF	1,000	50	1949	4,600
Avon River Power Co	Montreal Engineering Co	Black River Ext	New	Black	N.S.	1941	EF	750	80	1942	4,500
Avon River Power Co	Montreal Engineering Co	Paradise	New	Paradise	N.S.	1948	EF	.....	.....	1950	5,000
Nova Scotia Power Commission	K E Whitman	Dickie Brook	New	Dickie Brook	N.S.	1947	EF	1,656	41	1948	2,900
Nova Scotia Power Commission	K E Whitman	Deep Brook	New	Mersey	N.S.	1948	EF	2,600	45	1950	12,000
St. George Pulp & Paper Co			Red.		N.B.	1947	.....	.....	.....	1948	400
Northern Quebec Power Co	Power Corp of Canada	Quinze	New	Ottawa	Que.	1921	S&R	2,500	60	1923	20,000
Quebec Hydro-Elec Comm Beauharnois Lt Ht & Power Co		Beauharnois No. 1	New	St. Lawrence	Que.	1929	P&G	4,500	31	1932	440,000
Quebec Hydro-Elec Comm	H G Acres & Co	Beauharnois No. 2	New	St. Lawrence	Que.	1948	P&G	4,500	31	1951	318,000
Quebec Hydro-Elec Comm	Silas H Woodward	Rapid No. 7	New	Ottawa	Que.	1938	Earth	3,000	80	1941	48,000
Shawinigan Water & Pwr Co	Shawinigan Engineering Co	Shawinigan No. 3	New	St. Maurice	Que.	1946	.....	.....	.....	1948	195,000
Shawinigan Water & Pwr Co	Shawinigan Engineering Co	Trenche	New	St. Maurice	Que.	1948	CG	.....	.....	1950	325,000
Gatineau Power Co	Shawinigan Engineering Co	Farmers Rapids	New	Gatineau	Que.	1926	EE	3,600	56	1927	96,000
Gatineau Power Co		Brysen	New	Ottawa	Que.	.....	.....	.....	.....	.....	54,000
Electrique de Mont Laurier			New	Lievre	Que.	1948	.....	.....	.....	1950	2,650
Town of Jonquiere			New	.....	Que.	1947	.....	.....	.....	1949	4,200
Ogilvie Flour Mills	R A Rankin Co	Royal Mill	New	St. Lawrence	Que.	1948	.....	.....	.....	1949	3,200
City of Riviere du Loop	Roland & S P Beaulieu		New	Riviere du Loop	Que.	1947	.....	.....	96	1949	1,800
Rolland Paper Co			New	.....	Que.	1946	.....	.....	.....	1948	.....
J B Dube, Ltd		Lac Les Isles	Red.	.....	Que.	1947	.....	.....	.....	1948	45
Consolidated Paper Corp Ltd		Portneuf	Red.	.....	Que.	1947	.....	.....	.....	1948	210
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	Des Joachims	New	Ottawa	Ont.	1947	CG	5,500	165	1950	196,000
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	Aquasabon	New	Aquasabon	Ont.	1946	CG	950	110	1948	55,000
Hydro-Elec Power Comm of Ont	Hydro-Ele Power Comm of Ont	Stewartville	New	Madawaska	Ont.	1946	CG	1,300	200	1948	56,000
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	Tunnel	New	Mississagi	Ont.	1947	CG	950	230	1949	58,000
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	Pine Portage	New	Nipigon	Ont.	1947	CG	3,000	150	1950	82,000
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	Ear Falls	New	English	Ont.	1936	CG	60	46	1937	10,000
Hydro-Elec Power Comm of Ont	H G Acres & Co	Chenaux	New	Ottawa	Ont.& Que.	1948	CG	4,000	70	1951	198,000
Cananoque Elec Lt & Water Co	H G Acres & Co	Jones Falls	New	Rideau Canal	Ont.	1946	.....	.....	.....	1948	1,380
Town of Bracebridge	H G Acres & Co	High Falls	New	Muskoka	Ont.	1946	CG	230	20	1948	1,200
Abitibi Power & Paper Co	H G Acres & Co	Iroquois Falls	Red.	Abitibi	Ont.	1948	.....	.....	.....	1949	12,500
Orillia Water Lt & Pwr Comm	L G McNeice	Matthias	New	South	Ont.	1949	CG	792	35	1951	3,700
Pembroke Electric Co	H G Acres & Co	Waltham	Red.	Black	Que.	1940	CBS	250	30	1941	2,200
Great Lakes Power Co	Harza Engineering Co	High Falls	New	Michipicoten	Ont.	1949	CG	190	30	1950	23,300
Eaganville Lt & Pr Comm			New		Ont.	.....	.....	.....	.....	.....	320
Bancroft Municipal Elec			New		Ont.	.....	.....	.....	.....	.....	185
City of Winnipeg	Winnipeg Engineering Dept	Slave Falls	New	Winnipeg	Man.	1929	RF&C	3,000	80	1931	24,000
Northwestern Power Co	Power Corp of Canada	Seven Sisters	New	Winnipeg	Man.	1929	CG	620	80	1931	112,500
Manitoba Dept of Mines & Res Churchill River Power & Lt Co	H G Acres & Co Dr T H Hogg	Pine Falls Island Falls	New New	Winnipeg Churchill	Man. Sask.	1948 1936	CG	910	65	1951 1937	114,000 37,000
Canadian Dept of Mines & Res	Montreal Engineering Co	Snare River	New	Snare	N.W.T.	1946	EF	800	73	1948	9,000
Calgary Power Co	Montreal Engineering Co	Spray	New	Spray	Alta.	1948	REF	625	190	1950	62,000
Calgary Power Co	Montreal Engineering Co	Three Sisters	New	.....	Alta.	1948	EF	2,000	50	1950	3,600
Bridge River Power Co British Columbia Power Corp	Shawinigan Engineering Co B. C. Elec Co Engrg Staff	Bridge River	New	Bridge	B.C.	1946	EF	1,000	60	1948	62,000
	British Columbia Power Corp	Ruskin	New	Stave	B.C.	1929	.....	.....	.....	1930	47,000
Consolidated Mining & Smelting Co		Brilliant	New	Kootenay	B.C.	1942	CG	.....	140	1944	74,000
British Columbia Power Comm	H G Acres & Co	John Hart	New	Campbell	B.C.	1945	CG	2,900	140	1948	50,000
British Columbia Power Comm		Whatshan	New	.....	B.C.	.....	.....	.....	.....	.....	.....
British Columbia Pulp & Paper Co			New	.....	B.C.	1945	.....	.....	.....	1947	3,650
British Columbia Pulp & Paper Co		Flume House	New	.....	B.C.	1948	.....	.....	.....	1949	1,200
City of Nelson	A C R Yuill	Municipal Hydro Pl	New	Kootenay	B.C.	1947	CG	250	33	1949	.....
City of Revelstoke			New	.....	B.C.	1948	.....	.....	.....	1949	.....
Torbrit Silver Mines	Electric Power Equipment	Clearwater Lake	New	Clearwater	B.C.	1947	LC	50	10	1948	1,600
West Kootenay Power & Lt Co	West Kootenay Pr & Lt Co	Coat River	New	Coat	B.C.	1933	Arch	134	70	1933	1,050

Canada Hydro Table

The term "New" applies to an entirely new project on a site that has not been developed before.

"Redeveloped" indicates a project on a site that has been developed before and now has new wheels, generators and settings or a new plant.

CG, concrete gravity; CA, concrete arch; C&E, concrete and earth; EF, earth fill; MA, multiple arch; R&E, rock and earth fill; REF, hydraulic earth fill; P&G, piers and gates; CGE, concrete gravity and earth fill; CGG, concrete gravity with gates; S&R, sluiceways and rock fill; EF, rolled earth; CBS concrete buttresses and stoplog sluices; RF&C, rock fill and concrete gravity; LC, log crib.

AC —Allis-Chalmers Mfg Co
CAC —Canadian Allis-Chalmers, Ltd
CBS —Charles Barber & Sons
GGG —Gilbert Gilkes & Gordon, Ltd

Operation or Under Construction in 1948

Added cap No. of units	Date of added cap	Ultimate capacity, hp	No. of units installed	Waterwheel capacity, hp	Waterwheel, type	Speed, rpm	Static head, ft	Design head, ft	Waterwheel manufacturer	Governor manufacturer	Scroll case, concrete or steel	Penstock valve, type	Generator capacity, kva	Synchronizing automatic or manual	Thrust-bearing location	Design power factor	Kilovolts	Cycles	Generator manufacturer
1	1949	4,600	1	4,600	Propeller	240	51–48	45	DEW	W	Concrete	Head gt	4,000	Automatic	AG	0.85	6.9	60	CWC
		9,000	1	4,500	Francis	257	203	185	DLW	DEW	Plate st	Butterfly	3,500	Manual	AG	0.80	6.9	60	CWC
			1	4,500	Francis	450	203	185	DEW	W	Plate st	Butterfly	4,200	Manual	AG	0.85	6.9	60	CWC
.....	.....	5,000	1	5,000	Francis	720	506–502	476	CVL	CVL	Cast st	Gate valve	4,500	Manual	AG	0.80	6.9	60	CWC
.....	.....	4,350	2	1,450	Francis	900	273	261	CAC	W	Cast st	Gate	1,500	Manual	HS	0.80	2.4	60	CWC
.....	.....	12,000	2	6,000	Kaplan	200	46	46	MSC	W	Concrete	Head gt	5,000	Automatic	AG	0.80	6.9	60	CWC
.....	.....	.....	1	400	Francis	450	40	40	CBS	.....	Concrete	Head gt	Connects to existing generator						
.....	.....	.....	2	10,000	Francis	187	70–90	70	DEW	.....	Plate st	Head gt	10,000	Manual	AG	0.80	11.0	25	SEC
2	1928	119,000	2	10,000	Francis	187	70–90	70	DEW	.....	Plate st	Head gt	10,000	Manual	AG	0.80	11.0	25	SEC
1	1950		1	35,000	Francis	107	70–90	90	CAC	W	Welded st	Head gt	32,500	Manual	AG	0.80	11.0	25	CGE
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1 OC
6	1939–48	758,000	4	53,000	Francis	75	82–75	80	DEW	DEW	Concrete	Head gt	43,886	Manual	BG	0.85	13.2	25	3CGE
			4	53,000	Francis	75	82–75	80	DEW	DEW	Concrete	Head gt	46,625	Manual	BG	0.90	13.2	60	CGE
			2	8,000	Francis	180	82–75	80	DEW	DEW	Concrete	Head gt	7,200	Manual	.....	0.90	13.2	60	CGE
			6	53,000	Francis	75	82–75	80	DEW	DEW	Concrete	Head gt	46,625	Manual	BG	0.90	13.2	60	CGE
.....	.....	636,000	3	53,000	Francis	75	82–75	80	DEW	W	Concrete	Head gt	51,000	Automatic	BG	0.80	13.8	60	CWC
			3	53,000	Francis	75	82–75	80	CAC	W	Concrete	Head gt	51,000	Automatic	AG	0.80	13.8	60	CGE
1	1948	64,000	4	16,000	Francis	115.4	52–71	68	DEW	W	Concrete	Head gt	15,000	Manual	AG	0.80	13.8	25	1 WC
1	1949	195,000	2	65,000	Francis	120	150–130	145	DEW	W	Plate st	Head gt	62,500	Auto. & man.	AG	0.80	13.8	60	CGE
			1	65,000	Francis	120	150–130	145	DEW	W	Plate st	Head gt	62,500	Auto. & man.	AG	0.80	13.8	60	CGE
.....	.....	390,000	5	65,000	Francis	128.6	.....	160	DEW	W	Plate st	Head gt	53,000	Automatic	AG	0.90	13.8	60	CGE
1	1947	120,000	4	24,000	Francis	90	66	66	DEW	W	Plate st	Head gt	22,500	Manual	AG	0.85	6.6	60	CGE
			1	24,000	Francis	90	66	66	DEW	W	Plate st	Head gt	22,500	Manual	AG	0.85	6.6	60	CGE
1	1949	81,000	2	27,000	Francis	120	60	60	DEW	W	Plate st	Head gt	25,000	Manual	AG	0.80	6.9	60	CGE
			1	27,000	Francis	120	60	60	DEW	W	Plate st	Head gt	25,000	Manual	AG	0.80	6.9	60	CGE
.....	.....	.....	2	1,325	Propeller	180	22	22	DEW	.....	Concrete	Head gt	.....	.....	.....	.....	.....	.....	CGE
.....	.....	4,200	1	4,200	Kaplan	257	47	47	MSC	W	Concrete	Head gt	3,125	Manual	AG	0.80	2.75	60	CGE
.....	.....	3,200	2	1,600	Propeller	180	24	24	DEW	W	Concrete	Head gt	1,425	Manual	AG	0.80	2.3	60	CWC
.....	.....	1,800	1	1,800	Francis	400	96	96	MSC	W	Plate st	Head gt	1,500	Manual	AG	0.80	2.4	60	CGE
.....	.....	.....	1	.....	.....	1200	.....	.....	.....	.....	.....	.....	219	Manual	HS	0.80	0.55	60	CGE
.....	.....	45	1	250	Francis	250	23	23	CBS	.....	Open flume	Head gt	Belted to existing generator						
.....	.....	210	1	210	Francis	400	32	32	CBS	.....	Open flume	Head gt	Belted to existing generator						
.....	.....	496,000	8	62,000	Francis	105.9	135–124	130	DEW	W	Plate st	Head gt	50,000	Manual	AG	0.90	13.8	60	CWC
.....	.....	55,000	2	27,500	Francis	257	300–275	300	DEW	W	Plate st	Butterfly	22,500	Manual	AG	0.90	13.8	60	CWC
.....	.....	56,000	2	28,000	Francis	163.6	155–141	148	CAC	W	Plate st	Head gt	24,000	Manual	AG	0.85	13.2	60	CGE
.....	.....	58,000	2	29,000	Francis	211.8	219–214	200	CAC	W	Plate st	Head gt	23,500	Manual	AG	0.90	13.8	60	CWC
.....	.....	164,000	2	41,000	Francis	109.1	116–100	105	CAC	W	Plate st	Head gt	33,000	Manual	AG	0. 0	13.8	60	CWC
.....	.....	.....	2	5,000	Propeller	180	44–26	36	MSI	W	Concrete	Head gt	4,500	Manual	AG	0.85	6.6	60	OC
1	1940	25,000	1	7,500	Kaplan	150	44–26	36	MSI	W	Concrete	Head gt	6,000	Manual	AG	0.90	6.6	60	CWC
1	1948		1	7,500	Kaplan	150	44–26	36	MSC	W	Concrete	Head gt	6,000	Manual	AG	0.90	6.6	60	CWC
.....	.....	168,000	8	21,000	Propeller	94.7	41–25	40	DEW	W	Concrete	Head gt	17,000	Manual	AG	0.90	13.8	60	CGE
.....	.....	.....	1	1,130	Francis	514	62–56	58	CBS	W	Plate st	Head gt	10,000	Manual	HS	0.80	2.3	60	CGE
1	1949	3640	1	1,130	Francis	514	62–56	58	CBS	W	Plate st	Head gt	1,000	Manual	HS	0.80	2.3	60	CGE
.....	.....	.....	1	250	Francis	.....	62–56	58	CBS	W	Plate st	Head gt	335	Manual	HS	0.80	2.3	60	CGE
.....	.....	2,400	1	1,200	Francis	360	51–44	44	CBS	W	Plate st	Head gt	1,000	Automatic	HS	0.80	6.9	60	CGE
.....	.....	26,700	5	2,500	Francis	240	46–26	42.5	MSC	W	Open flume	Head gt	2,250	Manual	HS	0.90	12.5	60	CWC
.....	.....	3,700	1	3,700	Kaplan	257	42	42	MSC	W	Concrete	Head gt	3,125	Auto. & man.	AG	0.90	4.0	60	CGE
.....	.....	.....	1	2,200	Francis	514	132–125	125	JL	W	Cast st	Steel cone	1,800	Manual	HS	0.85	2.5	60	CWC
1	1945	12,500	1	2,500	Francis	360	132–125	125	MSC	W	Plate st	Steel cone	2,250	Manual	HS	0.85	2.5	60	CWC
1	1950		1	3,000	Francis	400	132–125	125	CVL	W	Plate st	Butterfly	2,812	Manual	AG	0.80	2.5	60	CWC
.....	.....	36,500	1	13,200	Francis	240	150–147	147	MSC	W	Plate st	Head gt	10,750	Manual	AG	0.90	11.0	60	CGE
1	1949	480	2	160	Francis	257	19	19	CBS	.....	.....	Head gt	.....	.....	.....	.....	.....	.....	CGE
			1	160	Francis	257	19	19	CBS	.....	.....	Head gt	.....	.....	.....	.....	.....	.....	CGE
1	1949	375	1	185	Francis	257	21	21	CBS	.....	.....	Head gt	156	Manual	HS	0.80	2.3	60	EEC
.....	.....	.....	1	185	Francis	257	21	21	CBS	.....	.....	Head gt	156	Manual	HS	0.80	2.3	60	EEC
.....	.....	96,000	2	12,000	Propeller	94.7	33–22	30	DEW	W	Concrete	Head gt	10,000	Manual	AG	1.00	6.6	60	SGE
6	1937–48		6	12,000	Propeller	94.7	33–22	30	DEW	W	Concrete	Head gt	10,000	Manual	AG	1.00	6.6	60	CGE
			3	37,500	Propeller	138.5	66	66	1-AC,1-DEW, 1-MS, 3W	.....	.....	Head gt	32,500	Manual	AG	0.85	11.0	60	CGE
2	1949–50	225,000	2	37,500	Propeller	138.5	66	66	DEW	W	Concrete	Head gt	32,500	Manual	AG	0.85	11.0	60	CGE
6	.....	114,000	6	19,000	Propeller	94.7	37	37	DEW	W	Concrete	Head gt	15,500	Auto. & man.	AG	0.80	13.8	60	CGE
1	1938		3	19,000	Propeller	150	56	56	DEW	W	Concrete	Head gt	18,000	Manual	AG	0.80	6.6	60	CGE
1	1939	114,000	1	19,000	Propeller	150	56	56	DEW	W	Concrete	Head gt	18,000	Manual	AG	0.80	6.6	60	CGE
1	1948		1	19,000	Propeller	150	56	56	DEW	W	Concrete	Head gt	18,000	Manual	AG	0.80	6.6	60	CGE
.....	.....	.....	1	19,000	Propeller	150	56	56	DEW	W	Concrete	Head gt	18,000	Manual	AG	0.80	6.6	60	CGE
.....	.....	9,690	1	9,500	Francis	128.5	56	56	MSC	W	Plate st	Head gt	7,500	Manual	AG	1.00	6.9	60	CGE
.....	.....	.....	1	190	Francis	900	56	56	CBS	W	Plate st	Head gt	150	Manual	HS	0.80	0.55	60	CGE
.....	.....	62,000	1	62,000	Francis	450	910	900	DLW	W	Cast st	Spherical	55,000	Automatic	BG	0.85	13.2	60	CWC
.....	.....	4,700	1	4,700	Propeller	277	62–30	50	DLW	W	Welded st	Butterfly	4,000	Automatic	BG	0.85	6.9	60	CWC
2	1949	620,000	1	62,000	Impulse	300	.....	1,130	PW	W	.....	Spherical pl	50,000	.....	AG	0.90	13.8	60	CWC
			2	62,000	Impulse	300	.....	1,130	VEW	W	.....	Spherical pl	50,000	.....	AG	0.90	13.8	60	CWC
1	1938	188,000	2	47,000	Francis	120	130	123	LLW	W	Plate st	Head gt	44,000	Manual	BG	0.80	13.2	60	CWC
1	1950		1	47,000	Francis	120	130	123	LLW	W	Plate st	Head gt	44,000	Manual	BG	0.80	13.2	60	CWC
1	1950	148,000	2	37,000	Francis	100	100	90	LLW	W	Plate st	Head gt	32,000	Manual	AG	0.85	13.2	60	CWC
			1	37,000	Francis	100	100	90	LLW	W	Plate st	Head gt	32,000	Manual	AG	0.85	13.2	60	CWC
2	1949	168,000	2	28,000	Francis	327.3	486–394	380	LLW	W	Plate st	Butterfly	25,000	Manual	AG	0.80	13.8	60	CWC
			2	28,000	Francis	327.3	486–394	380	LLW	W	Plate st	Butterfly	25,000	Manual	AG	0.80	13.8	60	CWC
.....	.....	.....	2	16,500	Francis	600	.....	650	CAC	.....	.....	.....	12,500	Manual	AG	0.90	6.9	60	CGE
.....	.....	3,650	1	3,650	Impulse	514	.....	920	PW	W	.....	.....	2,812	Manual	HS	0.80	4.16	60	CWC
									VEW										
.....	.....	1,200	1	1,200	Francis	900	.....	365	CAC	.....	.....	.....	.....	.....	.....	.....	.....	.....	CGE
.....	.....	13,500	1	6,750	Francis	164	70	70	CAC	W	Plate st	Head gt	6,000	Manual	AG	0.80	12.00	60	CGE
.....	.....	.....	.....	.....	.....	360	.....	.....	.....	.....	.....	.....	1,125	Manual	HS	0.80	4.15	60	CWC
.....	.....	1,600	2	800	Impulse	720	.....	750	GGG	GGG	.....	Gate valve	625	Automatic	HS	0.80	0.48	60	EEC
			1	250	Francis	.....	69	69	CAC	CAC	Cast st	Head gt	200	Manual	HS	0.8	2.3	60	CGE
1	1948	1,850	1	800	Francis	600	69	69	CBS	CAC	Plate st	Head gt	600	Automatic	HS	0.80	2.3	60	CGE
			1	800	Francis	600	69	69	CBS	CAC	Plate st	Head gt	600	Automatic	HS	0.80	2.3	60	CGE

CVL —Canadian Vickers, Ltd
DEW —Dominion Engineering Works, Ltd
JL —James Leffel & Co
MS —S Morgan Smith Co
MSI —S Morgan Smith-Inglis, Ltd
MSC —S Morgan Smith, Canada, Ltd

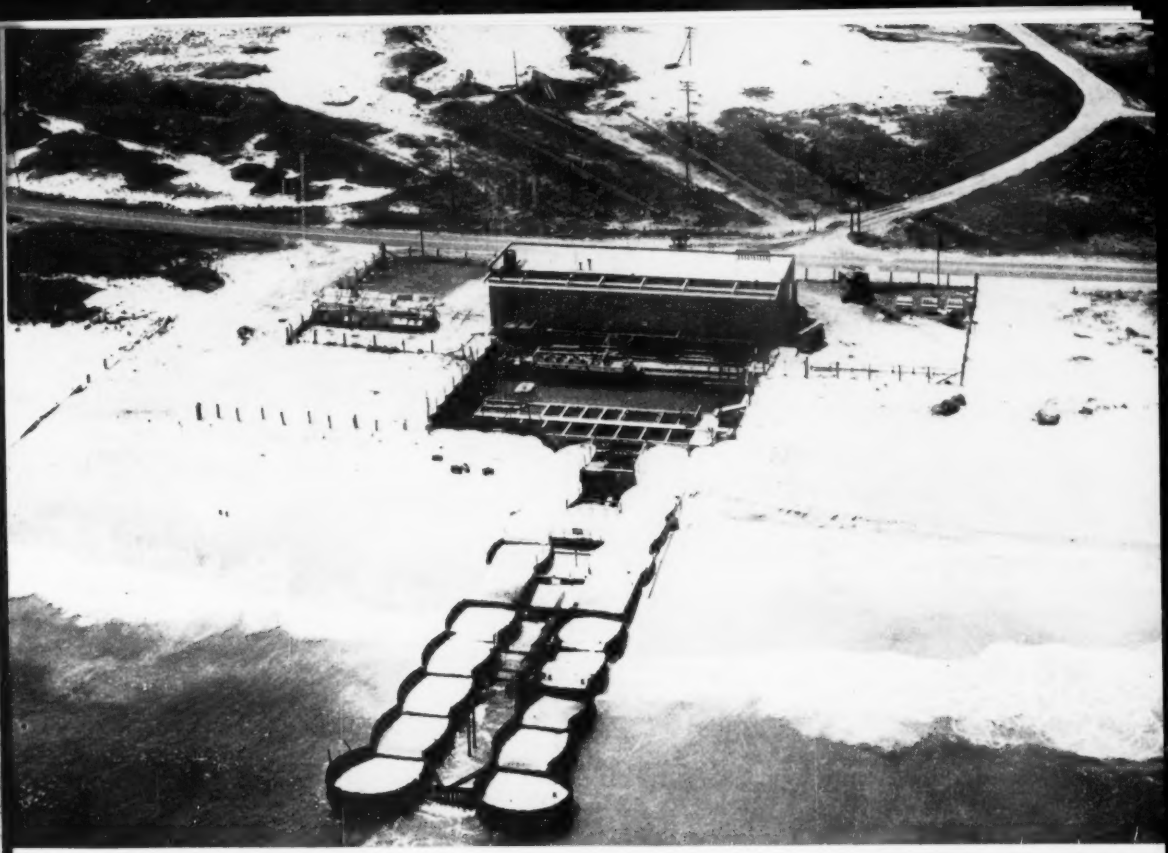
PW —Pelton Water Wheel Co
VEW —Vancouver Engineering Works, Ltd
CGE —Canadian General Electric Co, Ltd
CWC —Canadian Westinghouse Co Ltd
EEC —English Electric Co of Canada Ltd
OC —Oerlikon, Canada, Ltd

SEC —Swedish Electric Co. Ltd
SGE —Swedish General Electric Co. Ltd
*AG —indicates that the thrust bearing is above the generator; BG, thrust bearing is below the generator; HS, horizontal-shaft machine.

Hydroelectric Projects Constructed and Operated by Government Agencies

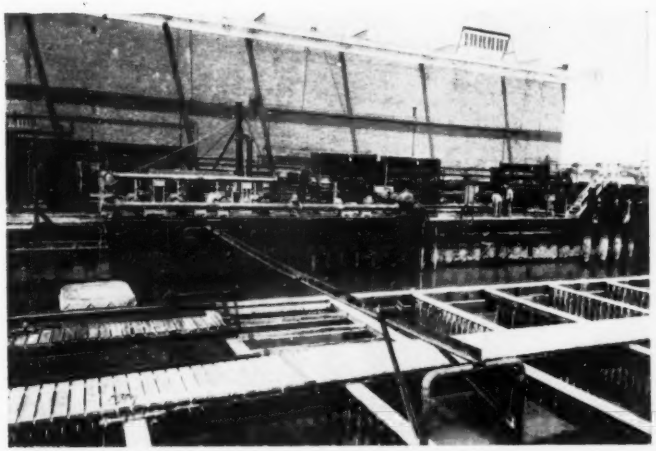
(Does not include municipal plants)

Government agency	Project	State	River	Ultimate capacity, hp	Initial capacity, hp	Installed capacity, hp	On order or being installed, hp
U. S. Bureau of Reclamation	Grand Coulee	Wash.	Columbia	3,012,000	523,000	1,513,000	1,499,000
	Hungry Horse	Mont.	S. F. Flathead	420,000	420,000	.....	420,000
U. S. Corps of Engineers	Bonneville	Ore. & Wash.	Columbia	729,000	137,000	729,000	.....
	Detroit	Ore.	Santiam	210,000	140,000	.....	.....
	McNary Dam	Ore. & Wash.	Columbia	1,550,200	345,200	.....	345,200
U. S. Bureau of Reclamation	Anderson Ranch	Idaho	Boise	55,500	37,000	.....	37,000
	Minidoka	Idaho	Snake	28,500	9,000	19,500	.....
	Shasta	Calif.	Sacramento	522,000	419,000	419,000	103,000
	Keswick	Calif.	Sacramento	102,000	102,000	.....	102,000
Imperial Irrigation District	Drop No. 3	Calif.	All Am. Canal	15,000	7,500	7,500	.....
	Drop No. 4	Calif.	All Am. Canal	28,300	13,300	13,300	15,000
U. S. Bureau of Reclamation	Parker Dam	Ariz. & Calif.	Colorado	160,000	120,000	160,000	.....
	Davis Dam	Ariz. & Calif.	Colorado	311,000	311,000	.....	311,000
	Hoover Dam	Ariz. & Nev.	Colorado	1,342,000	522,000	1,342,000	230,000
	Elephant Butte	N. M.	Rio Grande	34,500	34,500	34,500	.....
	Green Mountain	Colo.	Blue	30,000	30,000	30,000	.....
	Estes	Colo.	Big Thompson	63,000	63,000	.....	63,000
	Mary's Lake	Colo.	Big Thompson	11,300	11,300	.....	11,300
	Kortes	Wyo.	North Platte	55,500	55,500	.....	55,500
	Shoshone	Wyo.	Shoshone	20,000	20,000	20,000	.....
	Heart Mountain	Wyo.	Shoshone	8,300	8,300	8,300	.....
	Boysen	Wyo.	Big Horn	21,000	21,000	.....	21,000
	Seminoe	Wyo.	North Platte	45,000	45,000	45,000	.....
U. S. Corps of Engineers	Fort Peck	Mont.	Missouri	150,000	70,000	70,000	50,000
Platte Valley Pub Pr & Irr Dist	Sutherland	Neb.	North Platte	35,000	35,000	35,000	.....
Consumer Public Power Dist	Spencer	Neb.	Niobrara	3,740	1,540	1,540	2,200
Loup River Public Power Dist	Monroe	Neb.	Loup	9,600	9,600	9,600	.....
	Columbus	Neb.	Loup	54,000	54,000	54,000	.....
Central Neb. Pub Pr & Irr Dist	Jeffery Canyon	Neb.	Platte	26,000	26,000	26,000	.....
	Johnson No. 1	Neb.	Platte	26,000	26,000	26,000	.....
	Johnson No. 2	Neb.	Platte	50,000	25,000	25,000	.....
U. S. Corps of Engineers	Fort Randall	S. D.	Missouri	160,000	230,000	.....	.....
	Garrison	N. D.	Missouri	440,000	176,000	.....	.....
	St. Mary's Falls	Mich.	St. Mary's	72,750	23,925	.....	23,925
	Norfolk	Ark.	North Fork	168,000	42,540	42,540	42,000
	Bull Shoals	Ark.	White	214,000	162,000	.....	162,000
	Narrows	Ark.	Little Missouri	30,000	24,000	.....	24,000
Grand River Dam Authority	Pensacola Dam	Okla.	Grand	100,000	80,000	100,000	.....
U. S. Corps of Engineers	Fort Gibson	Okla.	Grand	96,000	64,000	.....	64,000
	Tenkiller Ferry	Okla.	Illinois	47,000	47,000	.....	47,000
	Dennison Dam	Okla. & Texas	Red	283,080	58,080	58,080	56,000
Lower Colorado River Authority	Buchanan Dam	Texas	Colorado	51,900	34,600	34,600	17,300
	Tom Miller	Texas	Colorado	20,000	20,000	20,000	.....
	Inks Dam	Texas	Colorado	16,000	16,000	16,000	.....
	Marshall Ford	Texas	Colorado	90,000	90,000	90,000	.....
	Granite Shoals	Texas	Colorado	66,000	66,000	.....	66,000
	Marble Falls	Texas	Colorado	46,000	46,000	.....	46,000
Brazos Riv Conser & Reclam Dist	Possum Kingdom	Texas	Brazos	51,000	34,000	34,000	.....
U. S. Corps of Engineers	Whitney Dam	Texas	Brazos	41,400	41,400	.....	41,400
	Wolf Creek	Ky.	Cumberland	377,000	377,000	.....	377,000
Tennessee Valley Authority	Kentucky	Ky.	Tennessee	220,000	176,000	220,000	.....
	Pickwick	Tenn.	Tennessee	288,000	96,000	192,000	.....
	Wilson	Ala.	Tennessee	610,000	206,000	470,000	140,000
	Wheeler	Ala.	Tennessee	360,000	90,000	225,000	135,000
	Guntersville	Ala.	Tennessee	136,000	102,000	102,000	.....
	Hales Bar	Tenn.	Tennessee	44,000	44,000	44,000	.....
	Chickamauga	Tenn.	Tennessee	144,000	108,000	108,000	.....
	Watts Bar	Tenn.	Tennessee	210,000	126,000	210,000	.....
	Norris	Tenn.	Clinch	132,000	132,000	132,000	.....
	Fort Loudoun	Tenn.	Tennessee	176,000	88,000	132,000	44,000
	Cherokee	Tenn.	Holston	166,000	83,000	83,000	.....
	Douglas	Tenn.	French Broad	166,000	83,000	83,000	35,500
	South Holston	Tenn.	South Holston	48,500	48,500	.....	48,500
	Watauga	Tenn.	Watauga	69,000	69,000	.....	69,000
	Fontana	N. C.	Little Tennessee	274,000	183,000	183,000	.....
	Apalachia	Tenn.	Hiwassee	106,000	106,000	106,000	.....
	Hiwassee	N. C.	Hiwassee	160,000	80,000	80,000	.....
	Chatuge	N. C.	Hiwassee	10,700	10,700	.....	.....
	Nottely	Ga.	Nottely	13,400	13,400	.....	.....
	Ocoee No. 3	Tenn.	Ocoee	33,500	33,500	.....	.....
	Wilbur Dam	Tenn.	Watauga	9,000	9,000	.....	9,000
U. S. Corps of Engineers	Buggs Island	Va. & N. C.	Roanoke	325,000	172,000	.....	172,000
	Philpott	Va.	Smith	19,640	19,640	.....	.....
	Central Hill	Tenn.	Carney Fork	189,525	189,525	.....	189,525
	Dale Hollow	Tenn.	Obey	75,000	50,000	50,000	25,000
	Allatoona	Ga.	Etowah	152,900	102,900	.....	102,900
	Jim Woodruff	Fla.	Chattahoochee	42,000	42,000	.....	42,000
	Clark Hill	Ga. & S. C.	Savannah	385,000	220,000	.....	220,000
S. Carolina Public Service Auth	Santee-Cooper	S. C.	Santee	213,000	173,000	173,000	.....
S. Carolina Public Service Auth	Santee-Spillway	S. C.	Santee	2,720	2,720	.....	2,720
Greenwood County Board of Comm	Buzzards	S. C.	Saluda	30,000	22,200	22,200	.....
Total capacity				17,104,425		7,725,160	5,436,970



KURE BEACH TESTING centers in this inlet basin and pump house, part of former plant for extracting bromine from sea water

How High Is Your IQ on Corrosion?



MAIN TEST BASIN: Racks in foreground hold submerged test specimens; equipment on dock includes pump and piping for full-scale and model tests of heat exchangers

By L N ROWLEY
Executive Editor

► NO MATTER HOW MUCH you know about corrosion the chances are you'd learn a little more if you visited Kure Beach, N. C., and talked with Frank LaQue. We did just that recently, to see what's new at the corrosion-testing station maintained there by International Nickel Co in cooperation with Dow Chemical Co. Frank LaQue of Inco developed and directs this project.

Talking informally with a group of us, LaQue mentioned the following as examples of the kind of information gleaned from the painstaking long-range research at Kure Beach:

Cathodic protection for heat exchangers looks promising, with two "ifs"—*if* the salt water is *outside* the tubes and *if* the zinc used is pure. Reason why results seem poor when salt water flows inside tubes: Current

Satisfactory results are assured with

A few of the outstanding features which assure satisfactory performance from Riley Traveling Grate Spreader Stokers . . .

1 Feeder Drive

The completely enclosed splash lubricated Riley feeder drive assures long trouble free operation and provides complete speed control from zero feed to maximum.

2 Overthrowing Distributor

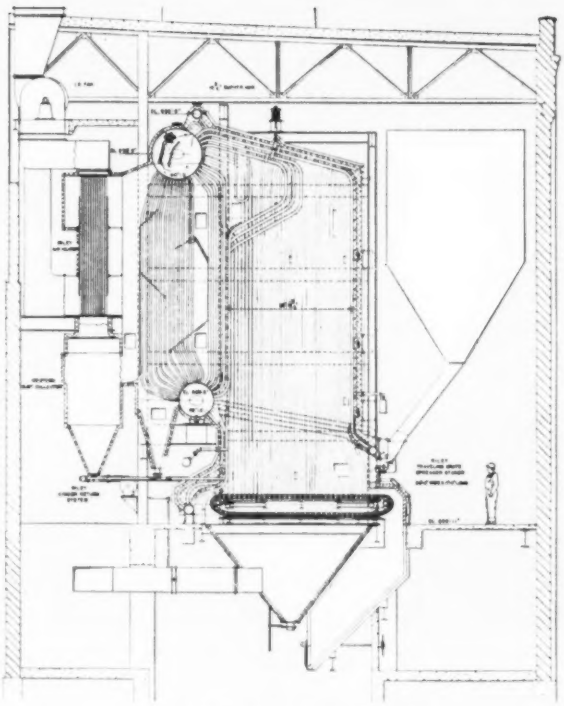
The Riley overthrowing distributor with adjustable blades provides uniform lateral and longitudinal distribution. Ready access to distributor is provided from front of stoker.

3 Hydraulic Grate Drive

Riley uses a hydraulically driven ratchet drive completely enclosed and automatically lubricated which is not susceptible to damage in case of grate obstruction and which requires but little power to drive.

4 Efficient Grate Surface

The Riley grate surface consists of grates 2″ wide by 6″ pitch assuring uniform air distribution and low maintenance. The grate clips are mounted on carrier bars which in turn are fastened to roller conveyor chains giving a true traveling grate surface.



Central Illinois Light Co., Springfield, Ill.
125,000 lbs. /hr. Riley Steam Generating Unit
fired by 20′ x 17′ Riley Traveling Grate Spreader Stoker

These well-known companies have ordered Riley Traveling Grate Spreader Stokers

Ohio Edison Company
Iowa-Illinois Gas & Electric Co.
Central Illinois Light Co.
Otter Tail Power Co.
Cliffs Power & Light Co.
Carbide & Carbon Chemical Corp.
Celanese Corp. of America
Swift & Company
Utica Knitting Co.
Sangamo Electric Co.
General Time Instrument Co.
Stokely Foods, Inc.
Armstrong Cork Co.
Kaiser-Frazer Corp.
Minnkota Power Co-operative
General Fireproofing
City of Provo, Utah
City of Eugene, Oregon
City of Ames, Iowa
University of Minnesota

RILEY

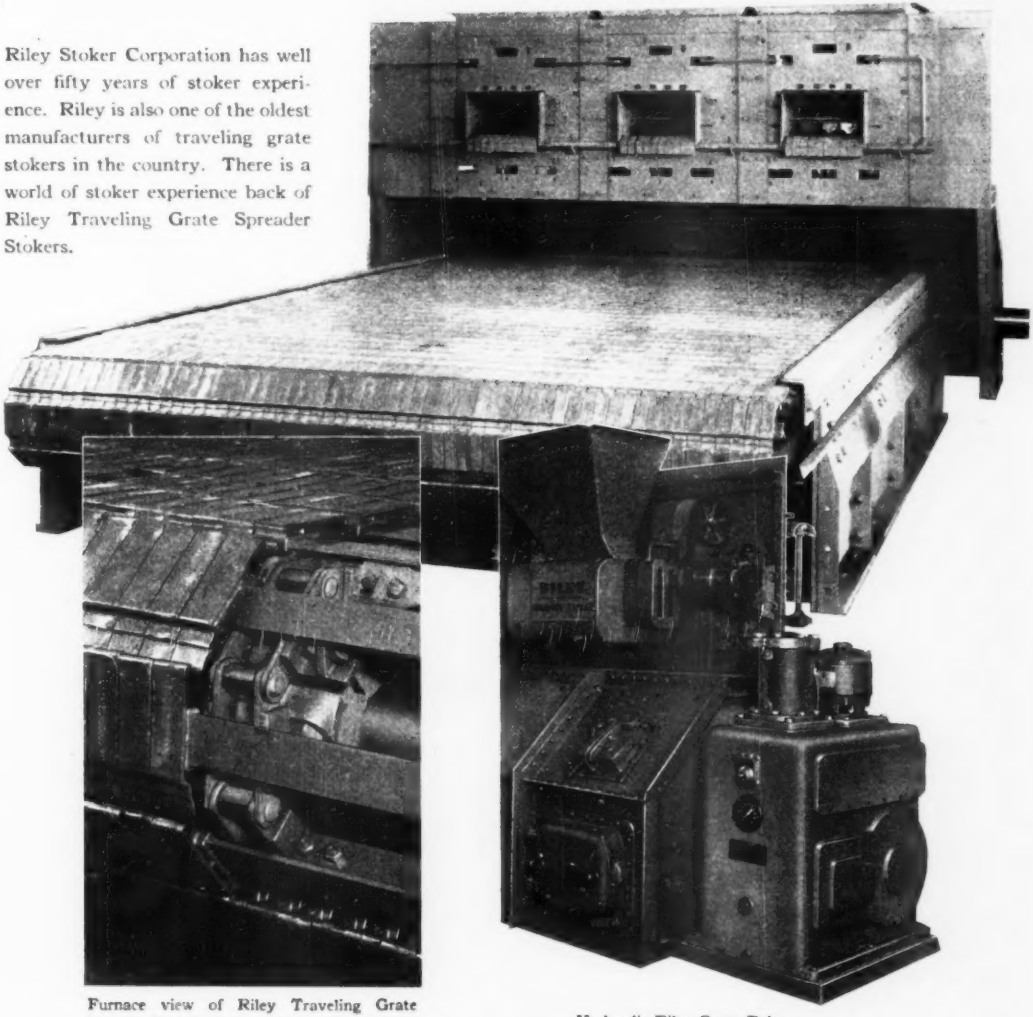
STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

RILEY traveling grate spreader stokers

Riley Stoker Corporation has well over fifty years of stoker experience. Riley is also one of the oldest manufacturers of traveling grate stokers in the country. There is a world of stoker experience back of Riley Traveling Grate Spreader Stokers.



Furnace view of Riley Traveling Grate Stoker. Enlarged view shows travel of grate around rear of stoker.

Hydraulic Riley Grate Drive
Note absence of chains and speed reducers

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

CORROSION *CONTINUED*

doesn't penetrate into the tubes. Sidelight: Cathodic protection is apt to be more difficult at high velocities.

As conditions of exposure become more severe, corrosion resistance of alloy-steels shows up better compared with carbon steels.

Steels corrode most where they have least opportunity to dry.

There is likely to be greater recognition of cathodic protection for permanent structures in salt water—docks, for example. It promises effective protection for one-third of the tidal range and all submerged areas.

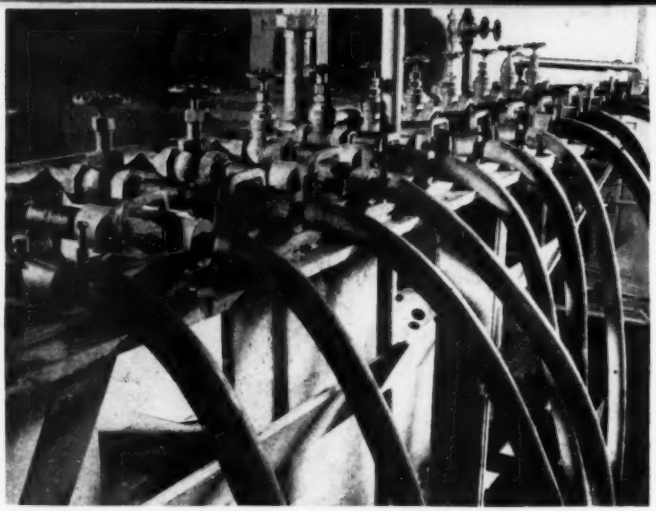
Without having seen the facilities at Kure Beach, it's difficult to visualize what lies behind such apparently simple conclusions as the examples cited above. Right now more than 15,000 specimens are taking a beating from the ocean atmosphere in test racks a little back from the beach. Over 10,000 specimens have been tested in sea water, with 2000 on the racks now.

Basic Belief. Basically, the Kure Beach program is built on the belief that the way to find out about corrosion is to watch it at work in its natural habitat—hence the acre of racks in which specimens try their strength against a marine atmosphere. These are about 250 yards back from the beach. Tougher conditions face materials exposed in a smaller group of racks only 50 ft from the shore. Here air is spray laden and wind driven.

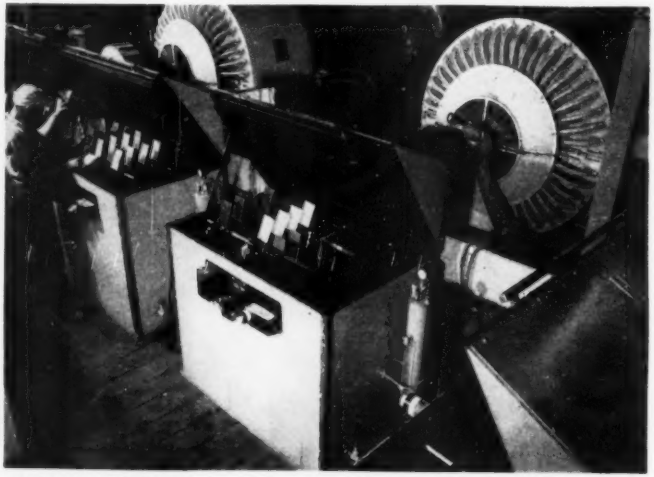
In the basin and pump house of a former bromine-extraction plant, test facilities "put the ocean in a test tube." Here are racks for immersion tests, full-sized metal piling exposed under natural conditions, pumps and piping for tests of heat exchangers, channels containing myriads of small specimens.

Laboratory-type tests go hand in hand with long-time "natural exposure" testing. In the pump house, using natural sea water, are special devices for simulating the corrosive and erosive action at the inlet of condenser tubes, for measuring galvanic potentials of metals and alloys, and many other purposes. Long-range natural-exposure tests serve to evaluate accuracy of accelerated laboratory methods.

The Kure Beach project is a truly cooperative venture. Established by Inco in 1935 to compare corrosion resistance of low-alloy steels with carbon steel, it has grown steadily in size and scope. Maintenance and development costs are shared by International Nickel and Dow Chemical. In cooperation with their producers, many materials—ferrous and nonferrous metals, protective and anti-fouling coatings and even rope—are put to the test. Data are freely exchanged and available to all industry as well as to government.

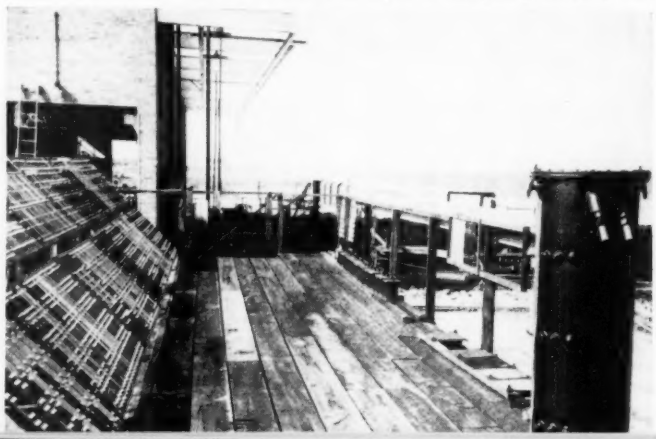


HIGH-SPEED GALVANIC TESTERS determine potential of various metals and alloys. Basic information of this kind is essential to ferreting out secrets of corrosion



SALT-SPRAY CABINETS create a synthetic ocean atmosphere. Results from such accelerated tests are compared rigorously with effects of natural ocean atmosphere

OCEAN AIR WITH A "BITE"—That's what these test specimens (left) must withstand month after month. Monel transformer case (right) is also getting salt-spray test



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SEPT.-49

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SEPT.-49

ECIALIST—4

neral Electric Co.

h you refer needs a cer-
ify the process demands.
sure and temperature of
rottle valve, the initial
enthalpy at the extrac-
and therefore a greater
equal the total Btu you

the same total Btu are
steam conditions. With
available per pound, so
the load. It is true that,
ds of steam to produce
bypassed. So far, how-
sumption from lowering

point, the only possibility
ent method of operation
condenser. Suppose you
g and 550 F. This would
lb and decrease the heat
Btu per lb. With a mini-
r hr the saving is 195,000
lb per hr or an estimated
u would consider such a
plication arising in the

h might turn this small
perating procedure if the
dropped too much, you
electric output needed,
ugh the turbine to extrac-
ntain additional capacity
e minimum steam to the
ejection to the condenser

MOST ECONOMICAL?

Turbine Specialist
District Office

Dear Mr Specialist.

We have in our plant a 5000-kw turbine-generator set running at steam conditions of 600 psig, 750 F, 1.5 in. Hg abs, with automatic extraction at 15 psig.

Our process steam demand has increased so that for several hours each morning we have to take 10,000 lb per hr of boiler steam through a reducing valve. The electrical load on the generator is not enough to provide all the extraction steam needed from the turbine.

Please tell me what reduced initial steam conditions I should use to get all process steam from the turbine extraction opening. If this will not work is there some other method I may use?

Sincerely yours,
ENGINEER

Dear Mr. Engineer.

Maintain your operating pressure and temperature even though some process steam is supplied directly from the boiler steam header. Here's why!

Under your conditions you are operating with minimum flow to the condenser and generating all your electric power from process steam. This is the most efficient way to operate an extraction turbine.

would increase at a rate of about 1000 Btu per lb of additional steam to the condenser. An increase of 196 lb per hr in this flow would wipe out all of the gain from lowering initial steam conditions.

The region in which you are trying to operate is the hatched area in the section to the left of the minimum-flow-to-exhaust line on the performance chart above. The nearer you can approach this line from the right without crossing, the better off you are since condenser flow will then be a minimum. This is the lowest possible heat rejection to the condenser.

A less efficient turbine could be built to supply your extraction demands, but you could not afford to keep this unit running at times when extraction demands are small.

My suggestion is to continue your present method of operation since this will be more flexible and avoids the possibility of a large loss in economy instead of a small gain.

Sincerely yours,
TURBINE SPECIALIST

CORRECTION NOTICE

The author informs us of a typographical error in Data Sheet No. 205 appearing in POWER, July 1949, page 138. The two formulas given in the text have a minus sign in front of the quantity C. Both these signs should be changed to plus. This does not affect the chart, which is correct as it stands.

CORROSION *CONTINUED*

doesn't penetrate into the tu
light: Cathodic protection is
more difficult at high velocit

As conditions of exposu
more severe, corrosion res
alloy-steels shows up better
with carbon steels.

Steels corrode most where
least opportunity to dry.

There is likely to be great
tion of cathodic protection
nent structures in salt wa
for example. It promises ef
tection for one-third of the
and all submerged areas.

Without having seen the
Kure Beach, it's difficult t
what lies behind such appa
ple conclusions as the exa
above. Right now more t
specimens are taking a bu
the ocean atmosphere in t
little back from the beach.
specimens have been tes
water, with 2000 on the ra

Basic Belief. Basically,
Beach program is built o
that the way to find out abo
is to watch it at work in
habitat—hence the acre
which specimens try the
against a marine atmosp
are about 250 yards bac
beach. Tougher condition
terials exposed in a small
racks only 50 ft from the
air is spray laden and wint

In the basin and pump
former bromine-extraction plant, test facilities "put the ocean in a test tube." Here are racks for immersion tests, full-sized metal piling exposed under natural conditions, pumps and piping for tests of heat exchangers, channels containing myriads of small specimens.

Laboratory-type tests go hand in hand with long-time "natural exposure" testing. In the pump house, using natural sea water, are special devices for simulating the corrosive and erosive action at the inlet of condenser tubes, for measuring galvanic potentials of metals and alloys, and many other purposes. Long-range natural-exposure tests serve to evaluate accuracy of accelerated laboratory methods.

The Kure Beach project is a truly cooperative venture. Established by Inco in 1935 to compare corrosion resistance of low-alloy steels with carbon steel, it has grown steadily in size and scope. Maintenance and development costs are shared by International Nickel and Dow Chemical. In cooperation with their producers, many materials—ferrous and nonferrous metals, protective and anti-fouling coatings and even rope—are put to the test. Data are freely exchanged and available to all industry as well as to government.

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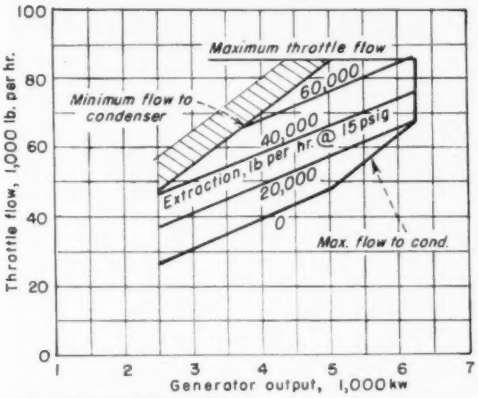
SALT-SPRAY CABINETS create a synthetic ocean atmosphere. Results from such accelerated tests are compared rigorously with effects of natural ocean atmosphere

OCEAN AIR WITH A "BITE"—That's what these test specimens (left) must withstand month after month. Monel transformer case (right) is also getting salt-spray test

LETTERS FROM A TURBINE SPECIALIST—4

By E W BURSTADT and E V POLLARD, *Turbine Divisions, General Electric Co.*



FOR MOST EFFICIENT RESULTS operate automatic-extraction turbines with minimum steam flow to condenser. If additional extraction flow is needed, bypass it via reducing valve

HOW TO SUPPLY PEAK EXTRACTION DEMANDS MOST ECONOMICALLY

Turbine Specialist
District Office

Dear Mr Specialist,

We have in our plant a 5000-kw turbine-generator set running at steam conditions of 600 psig, 750 F, 1.5 in. Hg abs, with automatic extraction at 15 psig.

Our process steam demand has increased so that for several hours each morning we have to take 10,000 lb per hr of boiler steam through a reducing valve. The electrical load on the generator is not enough to provide all the extraction steam needed from the turbine.

Please tell me what reduced initial steam conditions I should use to get all process steam from the turbine extraction opening. If this will not work is there some other method I may use?

Sincerely yours,
ENGINEER

Dear Mr. Engineer,

Maintain your operating pressure and temperature even though some process steam is supplied directly from the boiler steam header. Here's why!

Under your conditions you are operating with minimum flow to the condenser and generating all your electric power from process steam. This is the most efficient way to operate an extraction turbine.

I assume that the process to which you refer needs a certain number of Btu per hour to satisfy the process demands. If you were to lower the initial pressure and temperature of the steam entering the turbine throttle valve, the initial *enthalpy* (energy) would drop. The enthalpy at the extraction opening would also be reduced and therefore a greater flow of steam would be needed to equal the total Btu you originally had.

For the same power requirements the same total Btu are used in the turbine regardless of the steam conditions. With lower initial enthalpy, less energy is available per pound, so more pounds are needed to produce the load. It is true that, if the turbine requires more pounds of steam to produce power, fewer pounds will have to be bypassed. So far, however, there is no gain in fuel consumption from lowering initial steam conditions.

From the heating and power viewpoint, the only possibility for making a saving over your present method of operation is to reduce the heat rejection to the condenser. Suppose you lowered initial conditions to 350 psig and 550 F. This would drop initial enthalpy 100 Btu per lb and decrease the heat rejected to condenser by about 65 Btu per lb. With a minimum flow to condenser of 3000 lb per hr the saving is 195,000 Btu per hr. This means about 200 lb per hr or an estimated saving of 20¢ per hr. I am sure you would consider such a saving too small to offset the complication arising in the operating schedule.

There is another condition which might turn this small gain into a larger loss. Under this operating procedure if the initial pressure and temperature dropped too much, you might not be able to produce the electric output needed, even with maximum steam flow through the turbine to extraction opening. The only way to obtain additional capacity then would be to pass more than the minimum steam to the condenser. In this event, the heat rejection to the condenser would increase at a rate of about 1000 Btu per lb of additional steam to the condenser. An increase of 196 lb per hr in this flow would wipe out all of the gain from lowering initial steam conditions.

The region in which you are trying to operate is the hatched area in the section to the left of the minimum-flow-to-exhaust line on the performance chart above. The nearer you can approach this line from the right without crossing, the better off you are since condenser flow will then be a minimum. This is the lowest possible heat rejection to the condenser.

A less efficient turbine could be built to supply your extraction demands, but you could not afford to keep this unit running at times when extraction demands are small.

My suggestion is to continue your present method of operation since this will be more flexible and avoids the possibility of a large loss in economy instead of a small gain.

Sincerely yours,
TURBINE SPECIALIST

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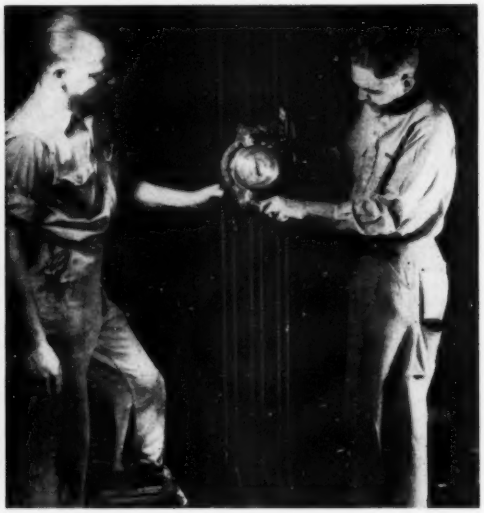
ROPE INSPECTION: Causes of replacement are all visible on outside wires; from these, elevator rope conditions are judged



ROPE TENSION: Each regular inspection of multiple-rope elevators should include tension check to insure equal loading

Good Inspection Methods Keep

Here are elevator-rope constructions and inspection procedure that insure maximum life with a high degree of safety. Standard inspection that can be adapted universally is suggested

BY A J MORGAN
Chief Engineer, Wire Rope Engrg Div
John A Roebling's Sons Co

► WIRE ROPE IS USED almost exclusively for hoisting and lowering elevators. One reason is that its physical characteristics help make elevators the comfortable, smooth-operating means of transportation they are. Other factors relate to cost and economy of operation. But most important is the fact that wire rope is the safest and most reliable material obtainable for elevator service. It is, therefore, of interest to review briefly why it is superior to other materials because this safety quality is intimately connected with its inspection, which we are to discuss.

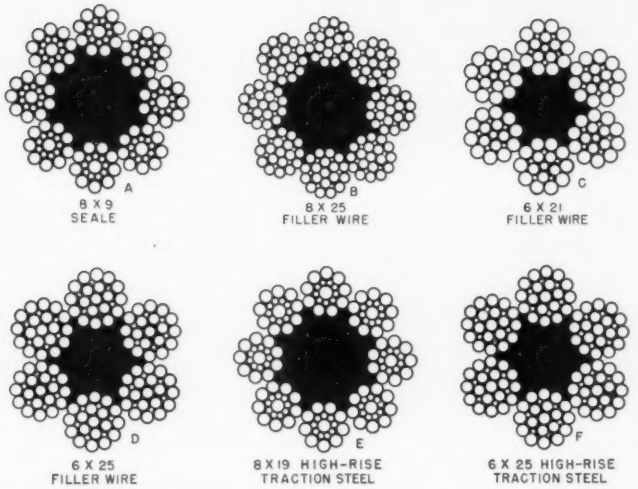
Wire-Rope Types. A wire rope is made of many parts, designed and fabricated in a way to give it strength, as well as resistance to abrasion, bending and other operating factors. These qualities are combined to best meet the conditions that the ropes encounter in service. Some ropes have to withstand severe wear, while others must be very flexible. Often both factors are involved and the ropes must be designed to have equal resistance to each.

In some types, elasticity is the primary factor, while in others the most important factors are resistance to corrosion, or crushing and distortion. The manufacturer can vary the materials that go into the rope, and the way the parts are put together to produce desired characteristics, but fundamentally he makes the rope from wires, strands and a core or center. Wires are laid helically around a center wire to form each strand, and then six or eight strands are laid helically around the core to complete the rope, see rope cross sections, facing page.

In elevator ropes there are no fewer than 114 wires and some types have as many as 200. In a new rope each wire is intact for the rope's length and each carries a share of the load. Thus the breaking of a few wires per lay does not materially impair the rope's strength. This makes wire rope far superior to other materials where failure of any one part because of a defect or wear would cause the whole structure to fail.

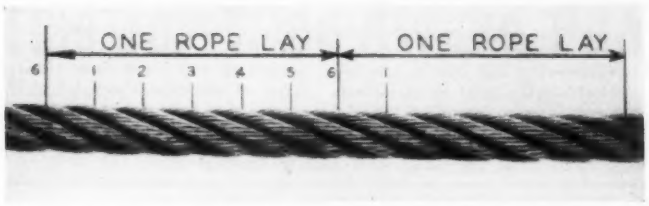
Outside Wires. A strand for an elevator rope has 10 to 13 of its wires on the inside where they are protected by the outside layer of wires. For the entire rope these inside wires total at least 60, and in ropes of other constructions as many as 104. Since these wires do not come in contact with sheaves or other objects tending to produce abrasion, and are generally not subject to the fatigue rate of outside wires, they can better be depended on to remain intact during the rope's life. For these reasons they form what is known as the rope's reserve strength.

Wires on the outside layer of each strand wear because of running over sheaves, and in time they break. Thus the two primary factors that lead to elevator-rope replacement are visible on the outside wires. It is from these visi-



ROPE CONSTRUCTIONS: Wire ropes are made of many parts, designed and fabricated to give strength and resistance to abrasion, bending and other operating conditions

Elevator Ropes Safe



ROPE LAY: A wire-rope lay is the distance along the rope in which a strand makes one complete revolution around the rope, as from 6 to 6 in this 6-strand wire rope

ble signs that we judge the rope's condition and how safe it is.

Other methods of judging a rope's condition have been proposed, and some seem to have merit. No doubt engineers have given thought to this subject and some day an improved method of inspecting ropes may be devised. To inspect a set of elevator ropes thoroughly is not an easy job, and a simpler way, if it were safe, would be desirable. But we do not know of a substitute for the careful visual examination by a competent inspector, and our efforts right now must be toward helping him perform his job properly.

Rope Identification. First, we can place an identification on a new rope when installed to show the inspector the date of its installation, size, grade and strength. The record should indicate whether the ropes are preformed or non-preformed. This is extremely important because preformed ropes require a somewhat different inspection technique than do the non-preformed constructions.

Most manufacturers have metal tags made expressly for this purpose that they supply with the ropes when an order so specifies. Many localities now require the use of such tags. They show the manufacturer's name, his reel number from which the ropes came, and space for the name of the company that installs the ropes.

The inspector should check the data on this tag within 30 days after the ropes are installed and make certain that they meet requirements for size and breaking strength specified by the elevator manufacturer's capacity plate on the car's crosshead. If there are rope-construction requirements check these also.

Inspection Schedule. Next establish a schedule for making inspections. Here a departure from the customary practice of making inspections once every three months appears warranted. New ropes show little change during the first few months of operation. On the other hand, they deteriorate more rapidly toward the end of their safe life. Therefore, would it not be better to increase the period between inspections during, say, the first half of the rope's life, and then shorten this period so inspections are more frequent during the latter half?

Where expected rope life is 18 months or less, I would propose that maximum intervals between inspections be four months for the first half of the expected life, two months for the third quarter, and one month for the remainder.

If expected rope life exceeds 18 months the maximum interval could be six months for the first half, four months for the third quarter, and two months for the remainder.

Elevator-Rope Life. The expected rope life on an existing elevator can be determined by an analysis of the histories of previous ropes used. On new installations an estimate of expected life would have to be based largely on service obtained on similar elevators of equivalent rise. The chief elevator inspector should decide the time interval between inspections on such installations, especially where elevators have been in service during building construction. It is suggested that the interval between inspections should not be greater than three months until the first broken wires or other unfavorable conditions develop and after that, every month while the rope remains in service.

If premature signs of reduced life develop, shorten the interval between inspections. If the ropes are accidentally damaged inspect them at once.

Generally, however, it should be possible to follow a schedule such as the one proposed, and in so doing use the inspector's time more effectively. His time would be conserved during the first half of the rope's life, and by more frequent inspections during the latter stages of operation both he and the owner should benefit. Many elevator

ropes are replaced prematurely not because of their condition at the time they are condemned but because of the inspector's fear that they may become dangerous within the 3-month interval before they are examined again.

Inspection Tips. When inspecting elevator ropes examine the full length and circumference of each rope, and the fastenings at their ends. Give special attention to sections operating around sheaves and drums since it is normally here that greatest wear occurs.

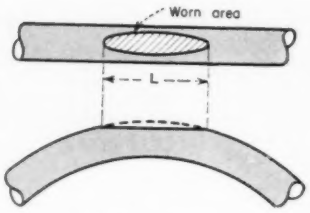
First make a general inspection along the length of all ropes. Then go back and examine more critically sections showing most wear or broken wires. The rope lay having the most wear and broken wire can be located and it is on the condition of this section that the rope's set is judged.

A rope lay is the distance along the rope in which a strand makes one complete revolution around the rope. This distance has been chosen since one lay bears a definite relation to the rope. It has been shown that the condition of the worst lay gives a fairly accurate guide to the rope's condition. It is the weak link.

Count the total number of broken wires in the length of the worst lay and record the number found in each strand over the length of this rope lay. Also, record wear on the crown surfaces of individual wires as measured along the major axis *L* of the ellipse forming the worn spot. Measure the diameter of the rope at this point and record it to the closest 64th of an inch.

Rope Record Cards. To record this data use a form card. On it mark the inspection date and rope service up to that time in months, or in car miles, if the latter is available. On the form, record the relative condition of other ropes in the set and any comments about corrosion, lubrication or other factors that help describe their condition more clearly. Keep the record of successive inspections on the same sheet, and when the ropes are removed record their total service life along with other information that gives a complete performance history. Keep one copy of this record on file with the building superintendent and another with the inspector for his information.

When making the inspection use a good light. A flashlight or one on an extension cord plugged in at the top of the car is suitable. Generally it is preferable to examine the ropes first without wiping them. Wiping tends to smear grease and dirt over the crown surfaces of the wires where contact with sheave grooves has kept them clean. When rope sections need a more careful examination use carbon tetrachloride or some other noninflammable grease solvent to clean the rope at the sections. Do not forget to relubricate these sections.



WORN WIRES: Wear on crown surface of each wire is measured along major axis *L* of the ellipse forming the worn spot

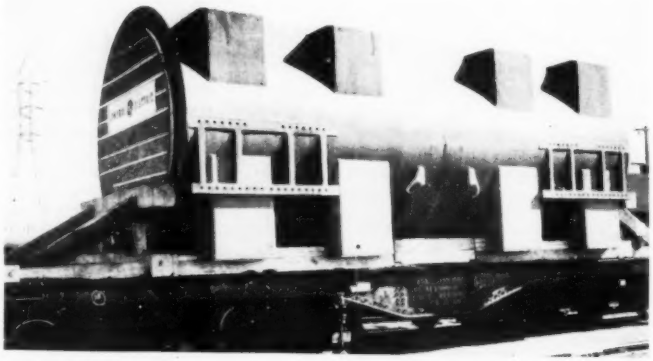
Aside from looking for the worst rope lay and measuring wear and rope diameter, and counting broken wires, the inspector should look carefully for signs of corrosion or other detrimental effect on the ropes. Corrosion is serious because by removing metal it reduces rope strength. Because corrosion may attack a rope internally as well as outside, its full effect may not be seen, making it impossible to judge a corroded rope's condition with any degree of accuracy.

Rope Lubrication. Proper lubrication will prevent corrosion from attacking the ropes. Therefore a suitable method of applying lubricant to them in the field is necessary. Lubricant originally put in the ropes by the manufacturer lasts for a time, but it gradually squeezes out and they become dry. Replenishing this lubricant periodically not only prevents corrosion but also keeps friction at a minimum.

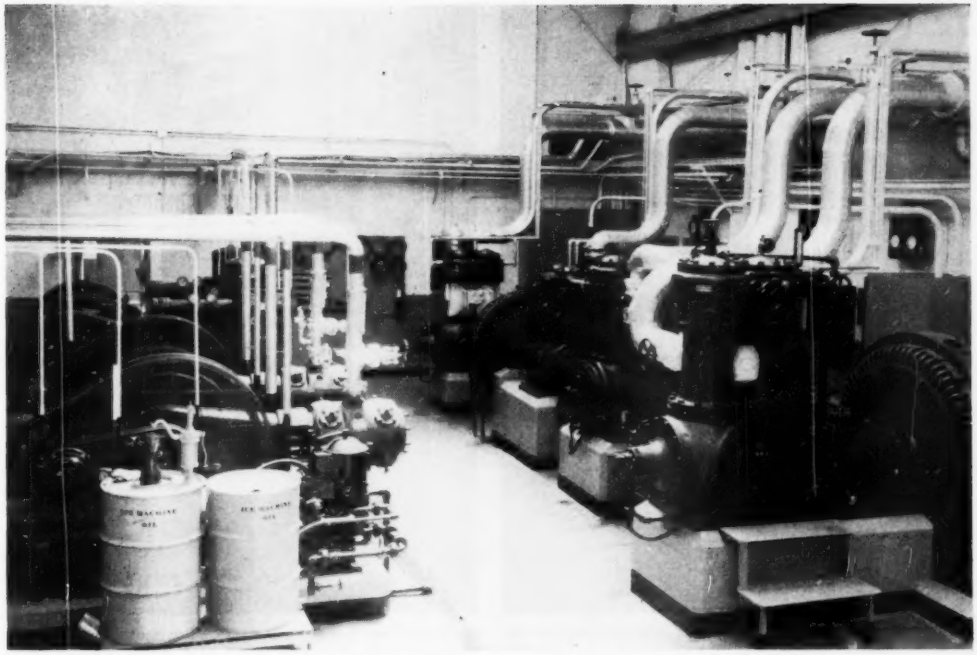
Lubrication of elevator ropes is important because sometimes the ropes have become so dry internally as to cause abrasion between wires, and between strands and core. Abrasion wears metal from the wires, but the fiber core generally takes the worst abuse and has its diameter reduced. The rope is now damaged because proper support for the strands is lost. An unaccounted-for reduction in rope diameter or increase in length or the appearance of red dust are the only indications of what has happened. Lubrication is, therefore, beneficial and necessary for the rope. When a good lubricating practice is followed it increases both rope and sheave life.

Preformed Rope. When inspecting preformed rope remember that broken wires do not show as prominently as in non-preformed. This is because the wires as well as the strands are set during fabrication to the shape they take in the finished rope. Therefore when a wire breaks, its ends do not stand out from the strand's surface as they do in non-preformed construction. The breaks are visible and should occur on the worn crowns as in other ropes, but a little more care should be used in their inspection to make sure of the rope's condition.

These suggestions for inspection are not new or foreign to many men doing this work. Some of the features mentioned vary from practice in some cases, but are presented because it is becoming increasingly important that a standard wire-rope inspection procedure be adopted. It will benefit both elevator inspectors and building superintendents because they want these ropes to give maximum service and absolute safety.



GENERATOR STATOR. The heaviest single piece of equipment ever shipped from the General Electric Schenectady Works, a 150,000-kw generator stator weighing 388,540 lb, was recently sent to Commonwealth Edison Fisk station, Chicago, Ill.



1 Flexible jumpers and S bends in air and refrigerating compressor discharge lines free the piping system of shaking forces from machine vibration. Neatness and clean surroundings go far in discouraging slipshod housekeeping here

Tips for Wide-Awake Power Engineers

Use these practical ideas to improve plant performance, speed up routine duties and promote neat housekeeping habits. A few extra gadgets can take the guesswork out of operation and prevent troubles that shut the plant down unexpectedly

► CLIMBING FROM fifth to first place in product sales within four years is no mean feat especially when you have to replace obsolete equipment at the same time. This is the record chalked up by the San Francisco Brewing Corp.

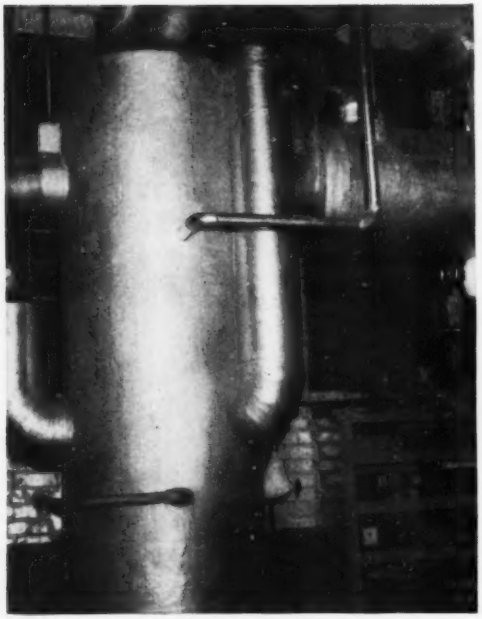
John Herzog, chief engineer, started by ripping out and replacing one piece of brewing equipment at a time. While this was going on he put in two new 13,000-lb-per-hr boilers and moved four of his refrigerating compressors from dingy areas into a roomy well-lighted space, Fig. 1. He is still in the throes of erecting new buildings and installing additional brewing and bottling equipment. When he will get done he doesn't know because the plant hasn't begun to meet local demands for its product.

Herzog is now planning for more power equipment and, even though the plant isn't finished, he has incorporated a lot of good ideas that can be adopted by other engineers faced with similar problems.

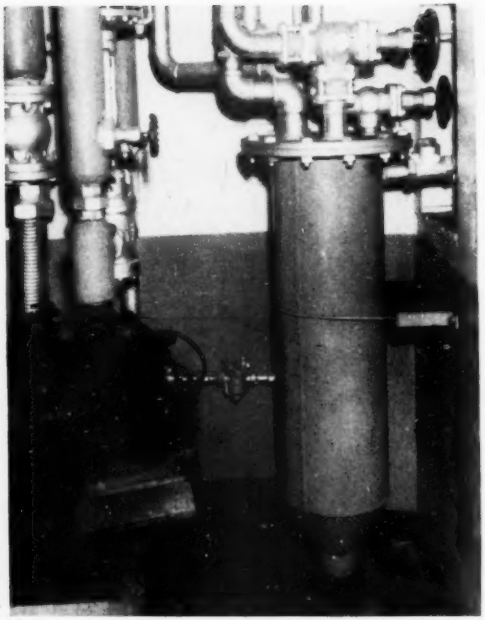
Reduces Water Bill. At a cost of $750 for a 200-gpm sand filter and $50 for material, John was able to reuse process water to the tune of saving $470 a month. As now arranged, rinse water from the bottle washer, instead of being wasted, goes to a 1000-gal storage tank he salvaged from old brewing equipment.

After passing through the filter, part of the water is heated to 140 F for beer pasteurization and the remainder is cooled to 50 F for cooling after pasteurization. Fresh water always goes to the washers for rinsing purposes but pasteurization and cooling can be done with rinse water because it does not come in contact with the beer. Four 100-ton evaporative condensers serve the ammonia system and compressors so now very little water goes to waste.

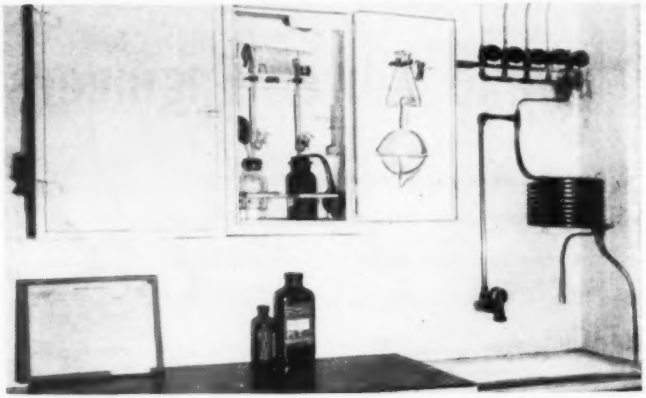
Pipe Vibration. Take a look at the S bends in the refrigerating compressor lines, Fig. 1. John put these in to eliminate piping trouble from machine vibration because an overhead crane



2 Suction lines from brewery coolers terminate in this accumulator, which catches the slugs of liquid carryover



3 Connecting a fire hose and opening the proper valve on ammonia disposer drains refrigerant harmlessly to sewer



6 Permanent sampling lines, a condenser, sink and table near reagent kit simplify water testing, save operator making trips back and forth getting samples

prevented supporting the pipes from the ceiling. Air compressors at the left have flexible metallic jumpers in discharge lines and rubber ones in intake lines. He uses the same type jumpers in pump piping. No rattles or shaking in these pipes. Steps and platforms at tall units bring the compressor valves within easy reach for starting and shutting down.

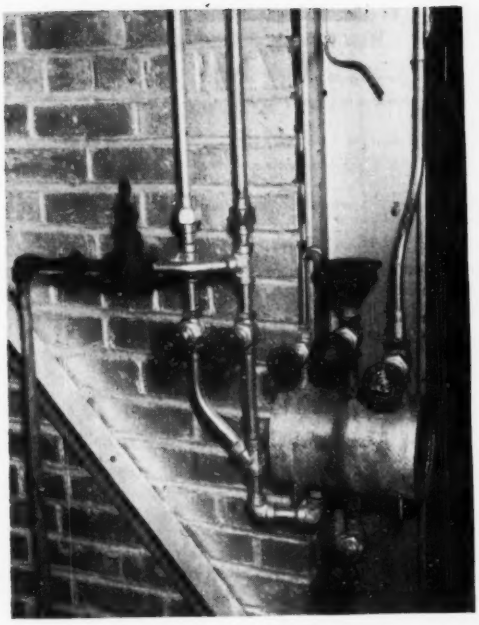
Accumulator. Suction lines from coolers throughout the brewery terminate in the accumulator, Fig. 2. A coil inside the shell, fed by high-pressure ammonia gas from the compressors, boils off any slugs of liquid carried over from evaporators. Boiling condenses the compressed gas and the resulting liquid returns to the receiver.

Refrigerant Disposal. Ammonia is always a hazard when fire breaks out. To minimize this danger Herzog installed a mixing tank, Fig. 3, which connects to various points on the refrigerating system. By manipulating shutoff valves at the mixer and connecting a fire hose, any section of the plant can be drained harmlessly to the sewer.

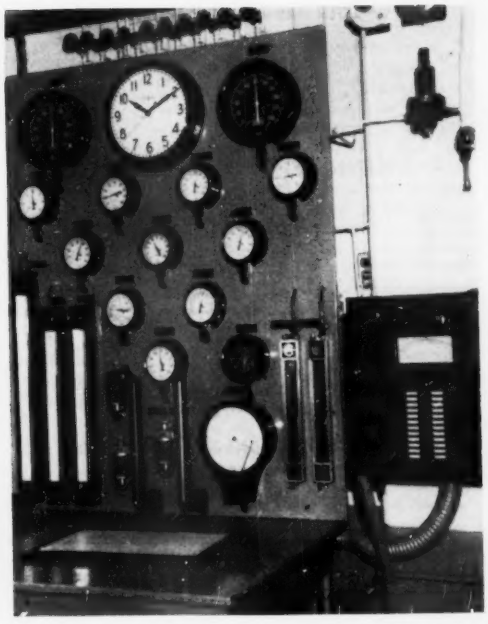
Safety Equipment. A neatly arranged tool board just inside the compressor-room door mounts a gas mask, fire extinguisher and first-aid kit as well as the tools needed to do an overhaul job. In case of trouble it is a simple matter to reach the gas mask when stepping inside.

Chemical Feeder. Feedwater gets treated internally by adding chemicals to the handy feeder, Fig. 4. Having all the valves in one spot makes it easy to drain the pot, add the chemicals, and feed them into either boiler. A line direct from boiler feed pump furnishes necessary water pressure to push chemicals into boiler drum.

Gage Board. For operating convenience and close supervision Herzog built and erected the gage board, Fig. 5, in the boiler room. It mounts gages for boiler steam and draft, emergency fuel-oil tank, steam pressure on lines serving various sections of the brewery, gas-fuel pressure, compressed air, feedwater tank, ammonia-suction and head



4 To be effective, feedwater treatment has to be injected with regularity. Simple feeder like this makes job easy



5 Mounting all instruments on a common panel centralizes important operating data so operator can spot trouble

pressure, carbon-dioxide compressor pressures, etc. At the right is a remote temperature indicator with a range of zero to 750 F for beer cellars, feedwater, brine, stack gas, hot water, etc.

Test Setup. John made feedwater testing easy and simple by mounting the test kit on the wall above a sink, Fig. 6. Permanent sampling lines come from each boiler and from bottling and brew house returns (to check for caustic soda and beer content). They terminate in the manifold mounted just above the sink. Condenser for cooling the sample consists of 21 ft of ¼-in. copper tubing slipped inside the same length of ½-in. size. The pair form into a 10-turn coil 8 in. in diameter. Outside tubing connects between water supply and faucet. Samples go through inside tube and discharge from open end. Chemicals, sampling flask, etc, are kept handy in the cabinet and a work table holds the log sheet.

Herzog is now negotiating for a 35,000-lb-per-hr boiler, which will more than double present steam capacity. To make room for it he is disposing of two diesel-engine generator sets installed for emergency use during a threatened power shortage. He is also planning for an additional 350 tons of refrigerating capacity, two 100-ton evaporative condensers and a 325-cfm air compressor.

7 John Herzog, the man behind it all, is always on the jump supervising new construction and erection in the brewery but he takes time to scrutinize reports

As indicated in the photographs the plant is the last word in cleanliness. Plant walls, machines and piping are kept painted and pipelines carry a full covering of insulation with color coding for easy identification.

Most unusual characteristic of this plant is the absence of ammonia odor. Amount of refrigerating capacity and the length of piping installed proves that ammonia can be kept penned up if reasonable care is taken. John says you won't have much trouble with leaks if you weld the lines, keep valve and shaft packing in good shape, and use flexible jumpers or S bends at compressors to eliminate vibration in the lines.

A firm believer in operator training Herzog keeps all his technical magazines displayed on a table in his office within easy sight of the engineers and mechanics. Not only that, he sees that they study the material relating to their jobs.

I—Direct Tube Costs, 50,000-Kilowatt Unit

Alloy	*Delivered cost*	*Installation cost*	*Salvage value, net*	*Net cost*
A	$25,200	$2,000	$8,800	$18,400
B	31,400	2,000	9,950	23,450
C	36,200	2,000	11,900	26,300

II—Total Annual Costs When Standby Units Are Available

Alloy	*A*	*B*	*C*
First cost	$27,200	$33,400	$38,200
Net cost	$18,400	$23,450	$26,300
Tube life, years	8	9	10
Depreciation factor	0.1085	0.09449	0.08329
Annual costs:			
Depreciation	$2,000	$2,220	$2,190
Interest on investment	1,090	1,340	1,530
Maintenance	680	600	540
Outage cost (Table III)	1,750	1,590	1,460
Total annual cost	$5,520	$5,750	$5,720

III—Allocated Annual Cost of Initial Outage For Condenser Retubing With Standby Units Available

1. Capacity factor during 2-week outage period 70%
2. Output if in service = 50,000 x 336 x 0.7 = 11,760,000 kwhr
3. Increment fuel cost of generation by standby units = 11,760,000 x 0.003 = $35,300
4. One third chargeable to condenser = (1/3)35,300 = $11,800
5. Equivalent annual cost (annuity) at 4% interest rate:
   - 8-yr life: 0.1485 x 11,800 = $1,750
   - 9-yr life: 0.1345 x 11,800 = $1,590
   - 10-yr life: 0.1233 x 11,800 = $1,460

IV—Total Annual Costs When 50,000-Kw Unit Outage Reduces the System Output

Alloy	*A*	*B*	*C*
Tube life, years	8	9	10
Annual costs:			
Depreciation	$2,000	$2,220	$2,190
Interest on investment	1,090	1,340	1,530
Maintenance	680	600	540
Outage cost (Table V)	4,020	3,640	3,340
Total annual cost	$7,790	$7,800	$7,600

V—Allocated Annual Cost of Initial Outage When It Causes Reduced System Output

1. Output for upper 50,000 kw (chart, p 117), 484,000 kwhr per day
2. Total reduction in system output for 2-week outage = 484,000 x 10 = 4,840,000 kwhr
3. Lost revenue at 1.25c per kwhr = 4,840,000 x 0.0125 = $60,500
4. Generation by standby units replacing 50-mw unit in off-peak hours = 11,760,000 − 4,840,000 = 6,920,000 kwhr
5. Increment fuel cost for standby-unit generation = 6,920,000 x 0.003 = $20,800
6. Total cost of unit outage = 60,500 + 20,800 = $81,300
7. One-third chargeable to condenser = (1/3) 81,300 = $27,100
8. Equivalent annual cost (annuity) at 4% interest:
   - 8-yr life: 0.1485 x 27,100 = $4,020
   - 9-yr life: 0.1345 x 27,100 = $3,640
   - 10-yr life: 0.1233 x 27,100 = $3,340

VI—Total Annual Costs When Standby Units Are Available, Tube Lives Are Longer

Alloy	*A*		*C*
First cost	$27,200	$33,400	$38,200
Net cost	$18,400	$23,450	$26,300
Tube life, years	8	10	12
Depreciation factor	0.1085	0.08329	0.06655
Annual costs:			
Depreciation	$2,000	$1,950	$1,750
Interest on investment	1,090	1,340	1,530
Maintenance	680	540	450
Outage cost (Table VII)	1,750	1,460	1,260
Total annual cost	$5,520	$5,290	$4,990

VII—Allocated Annual Cost of Initial Outage For Condenser Retubing of 50,000-Kw Unit

1. Outage cost chargeable to condenser (Table III) $11,800
2. Equivalent annual cost (annuity) at 4% interest rate:
   - 8-yr life: 0.1485 x 11,800 = $1,750
   - 10-yr life: 0.1233 x 11,800 = $1,460
   - 12-yr life: 0.1066 x 11,800 = $1,260

What Factors Should You Consider In Selecting Condenser-Tube Alloys?

By R. CARSON DALZELL
Chief Technical Adviser, Revere Copper and Brass Inc

Thoroughgoing economic analysis backed up by intelligent evaluation of intangibles is the only way to choose tube materials. Probable tube life, first cost, salvage value, interest rate, turbine-outage costs, operating convenience must be properly balanced

► "WHAT DO CONDENSER TUBES cost per year of service in my main condenser?" Operators of power stations, petroleum and chemical plants should be able to answer this question. Once they know, they will be in a position to answer the question, "What condenser-tube alloy can we afford to buy?"

To show how to go about answering these questions, we'll discuss some examples about a hypothetical unit.

First, steps should have been taken to control mechanical factors that are enemies of condenser tubes. These may be vibration, air-bubble entrainment, uneven water distribution, shells and sand, corrosive chemicals, sulphur-producing bacteria, etc. The only remaining element seems to be choice of tube alloy. Tests should be run in your condenser to give a sound engineering basis for predicting performance and life of several different alloys.

Suppose one alloy costs 44% more than another and is expected to last 25% longer. Jumping at conclusions, it would seem the better tube should not be chosen. Similarly, if several alloys have lives in proportion to their costs, it seems no choice should be made on basis of cost.

First cost and tube life, however, are only two of many factors. The complete picture should be examined carefully. In comparing items with different lives the only method that can be used will be the comparison of annual *total* costs. For tubes, the annual costs will consist of depreciation, interest on investment, annual operating and maintenance costs. An important consideration will be the cost of the loss-of-use or outage of the unit while the new tubes are being installed.

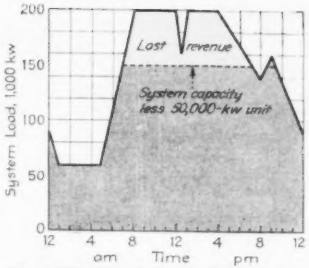
Depreciation is the amount of money that must be set aside each year to recover the cost of the equipment at the end of its life. The accepted method in engineering economics assumes that these amounts are invested in a sinking fund at a given interest rate compounded annually. Cost to be recovered by depreciation is the difference of installed cost and net salvage value. Salvage value equals scrap value, less removal cost.

Interest on investment is the amount of return that would have to be paid if the installed cost were "borrowed money." In other words, it's the income you would want from lending your money to someone else.

Annual maintenance costs for tubes consist principally of plugging leaking tubes.

Outage cost is more difficult to evaluate. In a central station a retubing job is rarely an emergency. Usually, turbine, generator, boiler and auxiliaries would undergo major repairs while the condenser was being retubed. Obviously, outage cost cannot be charged against a single item of equipment. In the cases below we assume one third of the cost is chargeable to retubing.

50,000-Kw Unit. Let's consider the retubing of a main condenser serving a 50,000-kw turbine in a central station. It has 5400 tubes, 7/8-in. dia. No. 18 gage, 24 ft 2 1/4 in. long. It is estimated that new tubes can be installed in 14 days. Installation, labor and overhead will cost about $2000.



ON SYSTEMS WITH CAPACITY equal to peak demand, loss of a unit shaves off top of load curve, reducing kwhr output

Table I lists costs and salvage value for three different alloys. The sum of delivered cost and installation cost represents the total investment.

Net salvage value assumes that 90% of the metal weight is recovered, and it costs $500 to remove the tubes. Net cost is the amount that must be recovered by the annual depreciation charges. The evaluation is based on an interest rate of 4%.

Annual maintenance costs are considered to be the unwatering, locating and plugging of leaking tubes. This costs about $5 per tube. About 20% of the tubes will be plugged over their useful life. This is assumed to progress evenly over this time with an equal number plugged each year. This makes a total cost of 5400x0.2x5 = $5400 to be divided into the years of useful life.

Table II shows the comparison for the three alloys having expected lives of 8, 9 and 10 years. Their first costs or investment and the net depreciable costs have been taken from Table I. The depreciation factor can be found in standard financial tables, or figured from $i/[(1+i)^n-1]$ where i is the interest rate and n the years of useful life.

Depreciation is the product of the depreciation factor and net cost. Interest on investment is 4% of the first cost. Maintenance is $5400 divided by the number of years of useful life. Outage cost is figured in Table III. Here it's assumed that the unit is part of a system that has adequate reserve capacity. When the unit goes out of service, older and less efficient units serve the load in its place. Capacity factor for the unit averages 70% when it's under load. Then for the 14-day outage its output of 11,760,000 kwhr is supplied by standby units.

Average fuel and supply costs for the 50-mw unit is 4 mils per kwhr. Average for the standby units is 7 mils per kwhr. Then the additional or increment cost of fuel and supplies will be 3 mils per kwhr because of the outage. This figures out to a total outage cost of $35,300. One third, or $11,800, chargeable to condenser must then be allocated as an annual charge. Since this sum is spent at the beginning of tube life, the annual charge will be the annuity the $11,800 would purchase during the useful life when invested at 4%. The annuity factors are given for the 8-, 9- and 10-year lives. These can be found in standard financial tables or figured from $i/[1-(1+i)^{-n}]$. These factors times the $11,800 outage charge give the annual equivalent charges.

These are listed in Table II. Adding up the individual annual charges we find the total annual charges are very nearly alike. Maximum difference (between *A* and *B*) is only $230. This is only 4.1% of the total. We would be lucky if we could predict all the figures used within 4% of their true value. Hence we can conclude that from a financial standpoint all alloys are equally desirable.

Other considerations would lead to the final choice. For instance, if money were tight the lower investment might be the practical course. On the other hand, the probably fewer service interruptions with the longer life tubes will be in their favor. If alloy *C* is more resistant to fouling because of a smoother surface, the higher heat transfer will be desirable. Other intangible factors will present themselves according to individual circumstances.

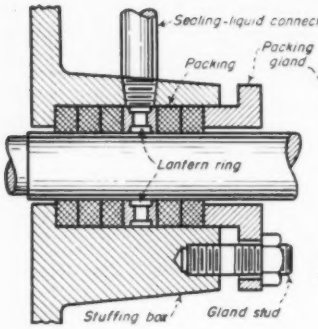
As a sidelight, suppose the retubing is the only reason for the unit outage, then the total outage cost should be charged into the annual costs. Let's see what happens. All we need do is add twice the annual outage charge (annuity) to the total costs of Table II as follows:

A	*B*	*C*
$5520	$5750	$5720
3500	3180	2920
$9020	$8930	$8640

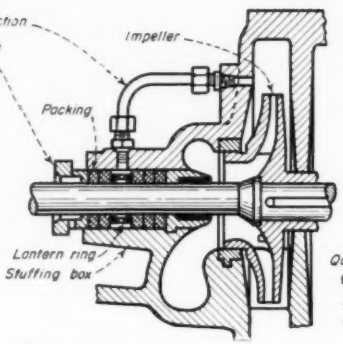
Here again the differences are not large, the maximum between *A* and *C* being $380 or only 4.4% of the total. Notice that the slight differential is in favor of *C*, whereas in Table II it is in favor of *A*.

No Reserve. Some systems are so tightly designed that they have no reserve capacity above the peak demand. Hence when a unit goes out of service, some customers cannot be supplied. This means a loss of revenue. The

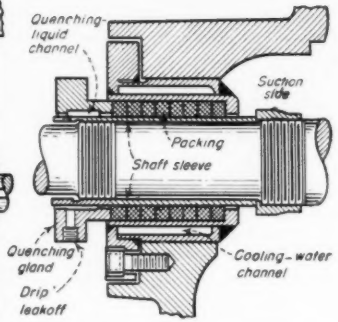
(Continued on page 170)



1 A centrifugal-pump stuffing box with a lantern ring in the packing space



2 Pressure liquid in a lantern ring helps to seal, lubricate and cool the packing



3 Watercooled stuffing box has quenching gland for the volatile liquids

Sealing a Centrifugal-Pump Shaft

Like skinning the proverbial cat, there are more ways than one to seal against leakage along a centrifugal's shaft. Here are several methods and conditions under which they are applied

By JOHN J COFFEY
Engineer, Pacific Pumps, Inc

► STUFFING BOXES and their closures are important parts of every centrifugal pump. They usually prevent leakage of the pumped liquid around the impeller shaft where it comes through the casing. But when the suction side of a pump operates at below atmospheric pressure, as on a condensate pump, the stuffing box must seal against air getting into the pump rather than against liquid getting out.

Lantern Ring. Fig. 1 shows a conventional stuffing box with a lantern ring or sealing cage, separating two groups of packing rings. Sealing liquid is piped under positive pressure to the chamber formed by the cage. This makes a seal beyond which air cannot pass. Lantern rings are used not only when pumps operate with a negative suction pressure (below atmosphere), but also when priming requires the exclusion of air from the pump. They are also used on pumps handling volatile liquids to prevent explosive gases reaching the atmosphere and to lubricate the packing.

When a pump handles clean, cool water the lantern ring may be connected directly to the casing of the pump, as in Fig. 2. If the pump is multistage, the lantern ring, if used, is connected to the first stage when sealing fluid comes from the pump. Sometimes a valve is put in this connection to control water flow to the lantern ring. When the pump handles high temperature or volatile liquids the lantern ring is usually connected to a separate source of cooling water, or other suitable cooling mediums.

When suction pressure is low to moderate the conventional stuffing box, Fig. 1, may be used without a lantern ring. This applies even when pumping most oil-refinery liquid hydrocarbons, whose temperature is not above 350 F and whose specific gravity is not below 0.6. But it is good practice to water-jacket the stuffing box, as in Fig. 3, when the temperature exceeds 250 F and the specific gravity at pumping temperature is less than 0.7.

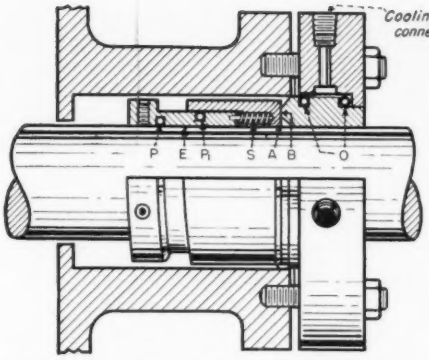
If the temperature of liquid hydrocarbons exceeds 350 F at moderate pressures, in addition to having the water jacket around the stuffing box, flush clean, cool oil through the lantern ring. This oil helps cool the stuffing box, and lubricates the packing. Keep lantern-ring oil pressure slightly above pump pressure on the packing, unless a small quantity of oil leaking into the pump will contaminate the product. Where the latter condition exists keep lantern-ring pressure below pump pressure on the packing.

When pumping some chemicals or caustic solutions at low suction pressures, if water or some other suitable sealing liquid cannot be used because of contamination, fill the lantern ring with grease under low positive pressure. There are several grease sealers available that supply grease under pressure to the lantern ring.

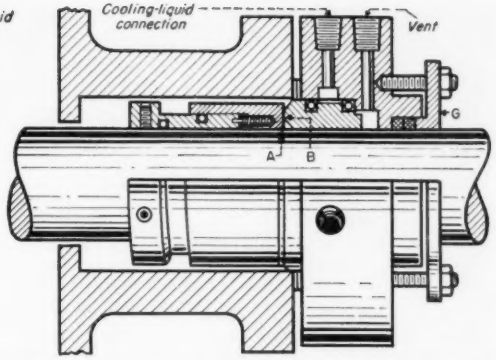
Mechanical Seal. Instead of packing a stuffing box to seal around a pump's shaft a mechanical seal may be used. Single mechanical seals, Fig. 4, will seal liquid hydrocarbons against pressures up to 600 psi at 250 F.

In the conventional stuffing box, tightening or loosening the gland nuts increases or decreases pressure on the packing to control leakage along the shaft. In a mechanical seal, the seal is formed between closely fitted surfaces, one running on the other, as at *A* and *B*. These surfaces are highly polished and lapped, the rotating element *E* being connected to the shaft. This element is made in two parts. One is fixed to the shaft and the other is movable, held to the stationary sealing surface by springs. A round packing *P* seals the fixed part of the rotating element along the shaft. Packing P_1 prevents leakage between movable and fixed parts.

Stationary surface *B* of the seal connects to the pump's frame. Leakage from the pump to the atmosphere is



4 Instead of packing a box to seal around a pump shaft a mechanical seal may be used with sealing surfaces *A* and *B*



5 For liquids vaporizing readily at atmospheric pressure and temperature, an auxiliary gland G may be added to the seal

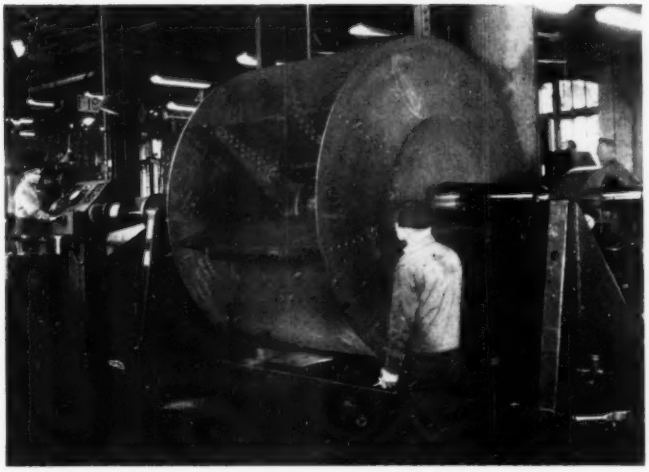
prevented by two ring packings *O*. The running joint between the lapped surfaces at *A* and *B*, also seals in the liquid. Any slight leakage between these surfaces escapes along the shaft to the atmosphere.

Auxiliary Gland. Light hydrocarbons of propane and butane that readily vaporize at atmospheric pressure and temperature complicate the sealing problem. For these liquids, an auxiliary gland *G* may be added to the seal, Fig. 5, to trap any vapors that may escape the seal, and vent them to safe disposal.

For some pump installations a double mechanical seal is used. It consists of two seals, placed back to back in the stuffing box. Cooling and flushing oil is circulated through the seals at a pressure greater than that at the shaft inside the pump. Double seals are particularly suitable where corrosive or gritty liquids are pumped or where pressures and temperatures are high.

Centrifugal pumps sometimes operate at pressures and temperatures that exceed the limits of conventional packing or mechanical seals. For these two applications a pressure reducing labyrinth or throttling bushing is placed around the shaft where it comes through the pump's casing. Leakage from this bushing is returned to a source of low pressure. In this way pressure on the packing or seal is reduced to a value under which it can safely operate.

Fan Rotor Is Given Precision Balance



► THIS BALANCING MACHINE locates unbalance, the cause of vibration in rotating devices like this 8½-ft-diameter 13,500-lb fan wheel and shaft, and does the job in a third the time needed for mechanical balancing. It is used by Westinghouse at Hyde Park, Mass. It is possible to balance dynamically large air-moving assemblies weighing from 1500 to 25,000 lb to 0.000025 in. of linear movement of the floating bearings.

Balancing fan wheel and shaft assemblies is done thus: (1) Fan wheel and shaft are placed in the floating bearings. (2) Prebalanced disks are tack-welded over fan-wheel inlet to decrease power needed to rotate fan wheel. (3) Fan-wheel shaft is connected to a motor and sine-wave generator. (4) Assembly is rotated at suitable balancing speed. (5) Unbalance is indicated by instruments on control panel; one gives amount of weight to add to bring one end of wheel in balance while a second indicates the angular position of this weight. (6) Balancing weight is welded or riveted to the wheel side plate. (7) Steps (4), (5) and (6) are repeated for the opposite end of the fan wheel to obtain correct balance.

MIRRORS CATCH LIGHT from windows in burner observation doors. Master mirrors pick up flame reflections from each mirror and relay them to television-camera lens (arrow). Coaxial cable connects camera to receiver in control room (next photo)

Television Proves Itself in the Plant

Successful operation at Ohio Power Co's Tidd Plant leads to installation on five large reheat boilers now under construction. Here's the way it's used for control-board observation of automatic lighter flames and boiler-water-level readings

By GRAHAM W BICE
Mechanical Engineering Division
American Gas and Electric Service Corp

► EARLY IN 1947 an experimental television set was installed in the Ohio Power Co's Tidd Plant at Brilliant, Ohio, in cooperation with the Diamond Power Specialty Corp. Reliable and satisfactory experience prompted installation of two additional sets. They were bought in 1948 and installed on a million-lb-per-hr boiler that went into service in the Fall of that year. Once again, results were satisfactory. This success led to purchase of ten additional sets. These are to be installed on five 935,000-lb-per-hr reheat boilers now under construction for the American Gas and Electric system.

What It Is. An industrial television set consists of two parts: a camera and a monitor or viewing apparatus. Each is fitted with its own power unit and voltage regulator. Both are tapped into a regular 120-v 60-cycle 2-wire branch circuit. Because camera and monitor need not be far apart, signals are transmitted by coaxial cable rather than by wireless. This is the major difference between industrial television and a home set.

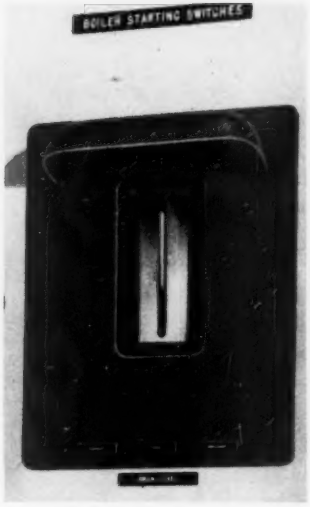
First Installation. Experimental set at Tidd Plant was arranged to reproduce the steam-drum water-glass indication, at elevation 744 ft, in the control room at elevation 677 ft. A suitable layout for doing this by mirrors had proved difficult to work out because of the distance (170 ft by the shortest practical path) and the need for five mirrors. The resulting image in the control room was extremely small. It was also dim, since each of the five mirrors absorbed about 7% of the light. On top of that, the observer's eye had to be at just the right spot to see it at all.

On the other hand, the image on the television monitor screen was about half the size of the actual water glass. The water level proved clearly visible and the monitor screen could be seen from almost any part of the room.

Permanent Sets. One of the two permanent television installations for the million-lb-per-hr boiler at the Tidd Plant reproduces the boiler-drum water-glass image in the control room. It duplicates the experimental setup except for a few minor changes.

The other permanent installation is somewhat more complex, as it handles a different job. It is designed to reproduce, in the control room, flame images from the furnace. Light from each of six diffusing-type circular observation windows, located in the furnace front wall just below burner level, reflects from six spaced mirrors into twin master mirrors (see photo above). The television camera lens focusses on these master mirrors. On the monitor screen in the control room, these windows appear as bright circles of light. Each is about ¾ in. in diameter and

FLAMES SHOW ON RECEIVER SCREEN in boiler panel as bright circles of light (upper right). This installation is in the Unit No. 2 control room at the Tidd Plant



DRUM WATER LEVEL is shown at control board by a separate television circuit

they are spaced across the 10-in. wide screen (see photo).

Latest Application. The first boiler now under construction at the Philip Sporn Plant (one of the five previously mentioned) offered an opportunity to apply fully experience gained in the past several years with flame-observation television equipment and with retracting automatic oil-lighter equipment.

This new furnace has special clear pyrex-glass observation windows arranged to give a direct light path from the center of each lighter flame to a compact system of permanent mirrors and thence to the television camera. A pressure fitting on each window permits continuous purging with forced-draft air to keep glass cool. This also prevents ash accumulation in furnace-wall openings.

When retracted, automatic oil lighters are completely shielded from furnace radiation. They are cooled by forced-draft air at all times. Simplified control circuits permit operation in pairs from pistol-grip switches on the main control board. This layout should make it possible for the boiler operator to manipulate oil lighters and coal burners with complete safety and without leaving the control room. There should be no need for an auxiliary operator at the burner deck during startup, shutdown and other periods of burner manipulation.

The boiler-drum water-glass installation for all new units will substantially duplicate the first experimental setup at Tidd, thus confirming the soundness of the original design.

Economics. Cost of an industrial television installation varies slightly with its arrangement. In general, it may be expected to run from eight to ten times the cost of a comparable home television receiving set.

A straight comparison of cost against expected savings from a television setup may not yield a clear-cut answer. Such a study, however, should always give weight to intangible gains resulting from better and safer over-all plant operation. Television apparatus fits in particularly well with the centralized control-room layouts now widely used.

As an operating instrument, television offers one big advantage over usual recording and remote-indicating devices. When it is operating, it gives a correct indication; when it is not operating, that fact is obvious. It thus avoids the possible hazard of an instrument that appears to be reading correctly but may be out of calibration or "stuck".

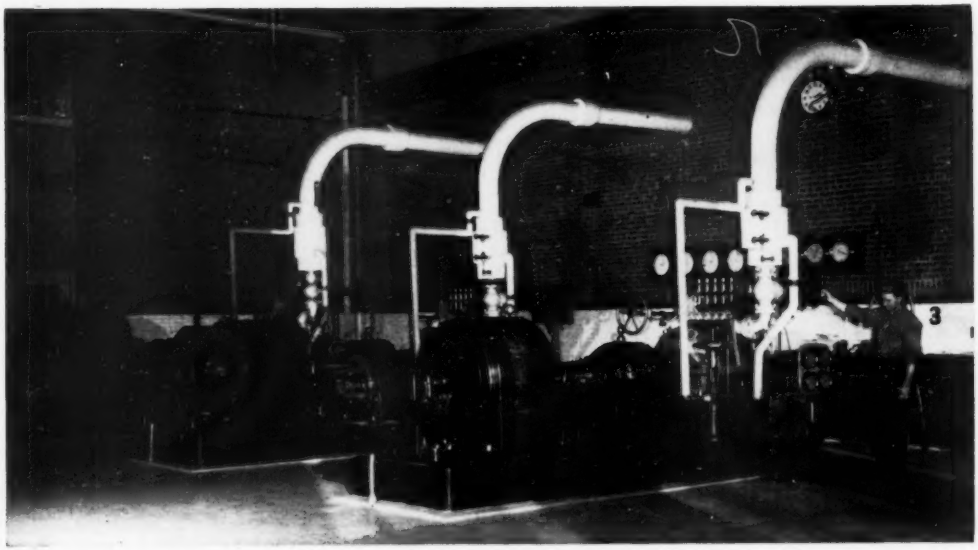
European Coal Situation Improved

With imports of coal from U. S., Marshall Plan countries now have enough for all essential needs according to a recent Economic Cooperation Administration report. Emphasis now shifts to improved efficiency and economy of production and distribution, increased European supplies.

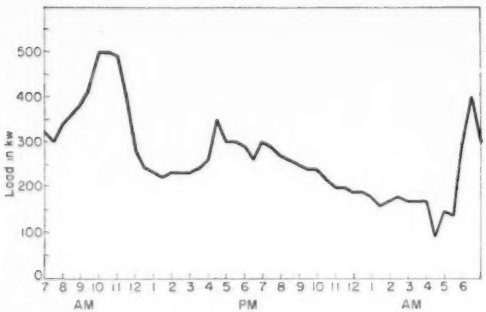
At the end of the war, the report points out, shortage of coal was a prime factor limiting European recovery. By 1948, however, ERP countries, as a result of imports from U. S., had enough coal for operation of most essential industries and services.

As a result of increased production, need for American coal in 1948 dropped to less than 50% of 1947 volume—from 37 million to 17 million tons. Internal coal and lignite production in participating countries increased from 399 million tons in 1946 to 473 million in 1948 and is expected to climb to 521 million in fiscal 1950.

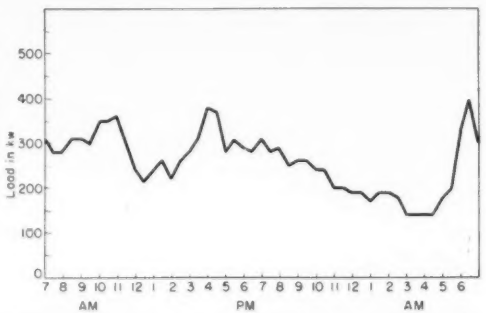
In addition to increased production, the report says, a start has been made on rehabilitation and reconstruction, additional manpower has gone into the mines, absenteeism has declined and transportation to consuming points has improved. Furthermore, the shortage of high-quality fuels, principally metallurgical coke and coke fines, has either been overcome or reduced.



1 Before load came under control these three turbine-generators had to meet unpredicted load demand without aid of adequate-size steam-supply mains. At high loads pressure drop reached 25 psi between boiler header and turbine throttle



3 Here's a typical "before the engineering" load curve that shows the strain of meeting an unpredicted load every day



4 By shifting the bakery operations from the morning to the afternoon the electrical load peak dropped considerably

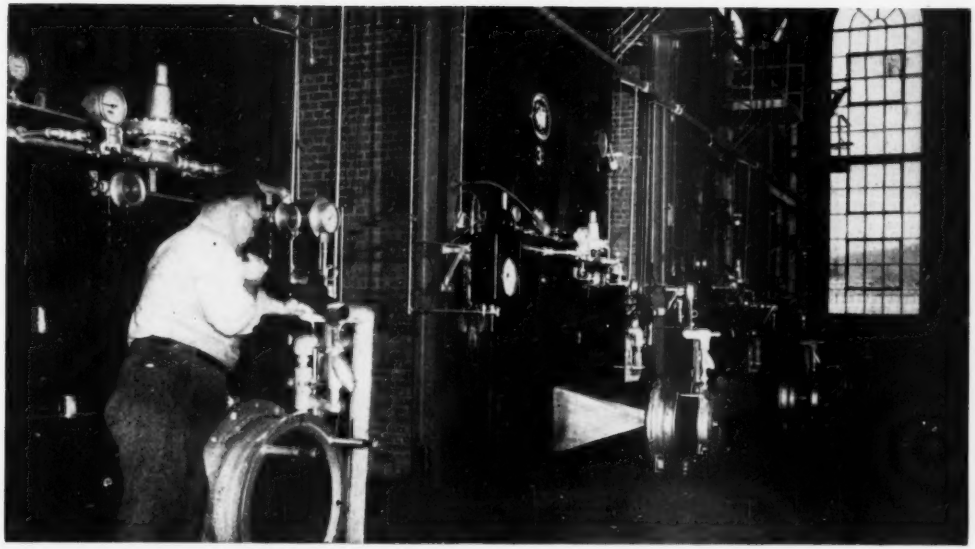
Good Engineering Keeps Load Curve in Its Place

Many small institutional plants spend all their time trying to follow their load curve. N C Avery, supt, plant and maintenance, Southbury Training School, tells how his plant applied sound engineering to fit the load curve to the equipment on the line

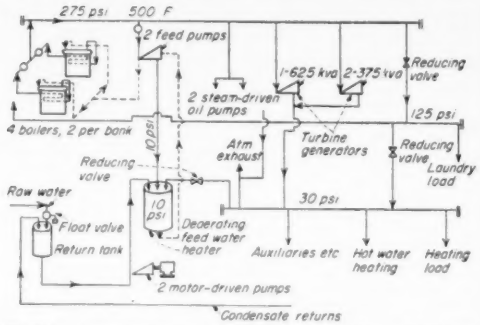
► FIVE YEARS AGO our four oil-fired steam boilers worked like mad to meet the load-curve demand. What was worse, the whole plant had to do the job in complete secrecy. Why? Because we hadn't a meter or recording instrument to even help us guess.

We felt that just as soon as the load let up, or the war ended, or something, we'd get to the bottom of things. But the load didn't let up. The war made things tougher. There was only one way out and that was to take action. We did.

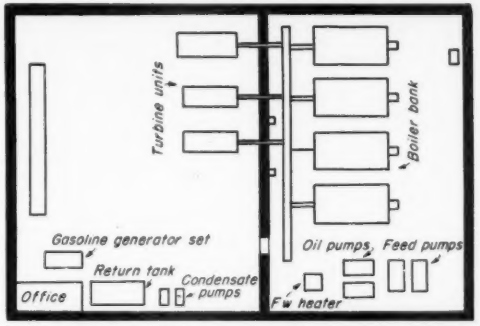
A consulting engineer came in and right off the bat predicted a $10,000 per year saving in fuel oil! (By the way, we made it and, what's more, carry five more buildings than we did then.)



2 Today with a full knowledge of the expected load demand plus ample meters to check on individual equipment performance a preventive maintenance schedule can be set up. That way the power plant can be kept operating at peak efficiency



5 Flow diagram pictures the steam distribution throughout the power plant and the principal steam-using equipment



6 Physical location of major power-plant equipment can be seen above. Pumps are installed one floor below turbines

Let's look at what we have now. Our school is a modern state institution for the care and training of handicapped children. It is located in the lower Berkshire Hills, Connecticut, about 200 ft above sea level. There are in all 65 buildings. In addition, a modern farm, about a mile and a half away, is part and parcel of the school setup. All buildings except the farm and three staff houses draw from the power plant for heating service.

The Power Plant. Our power plant, Fig. 6, houses four watertube boilers rated at about 15,000 lb per hr each, Fig. 2. They are oil fired with two burners per boiler. Steam comes off at 275 psi, 500 F, Fig. 5, to supply three turbine-driven generators—one rated at 625 kva and two at 375 each, Fig. 1. In addition to the steam demands for generating power there is the added load of (1) turbine-driven boiler feed pumps (2) steam-driven oil pumps (3) a reducing valve to feed a 125-psi header.

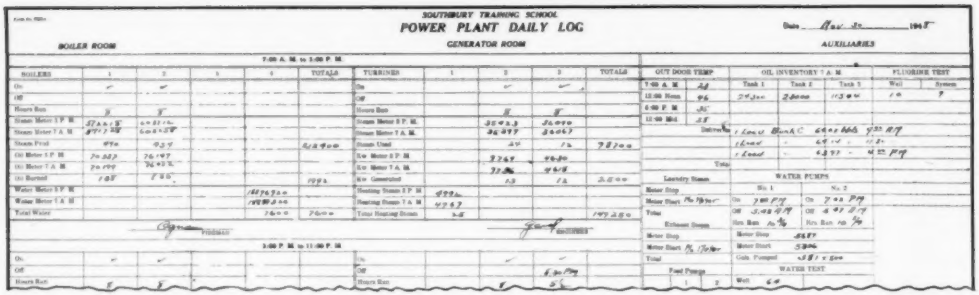
This 125-psi header handles steam for the laundry load—that is, to operate washers, driers and pressers.

Off the 30-psi header comes the building-heating system, plus the steam for producing hot water. All turbine-generators exhaust into this same header. A reducing valve connects into the header to deliver steam at 10 psi for the deaerating feedwater heater.

Supply of 10-psi steam for the deaerating feedwater heater — direct from the exhaust of the boiler feed pumps or from the 30-psi header—still gives us a bit of a headache. But more about this later.

Condensate returns and makeup water meet at a float-controlled return tank. The float operates a valve to feed makeup water automatically into the tank. From here motor-driven centrifugal pumps deliver the water to the deaerating feedwater heater. Temperature and pressure in this deaerator are maintained by a supply of 10-psi steam, discussed above.

Plant Operation. Before we applied good engineering know-how to operation, our plant can best be described by



SOUTHBURY TRAINING SCHOOL
POWER PLANT DAILY LOG
Date Nov 30 1948
BOILER ROOM — GENERATOR ROOM — AUXILIARIES

7:00 A. M. to 3:00 P. M.

BOILERS	1	2	3	4	TOTALS
On	✓	✓			
Off					
Hours Run	8	8			
Steam Meter 3 P. M.	57,811 K	40,814 K			
Steam Meter 7 A. M.	49,715 K	34,000 K			
Steam Fired	976	814			1,790
Oil Meter 3 P. M.	76,883	76,497			
Oil Meter 7 A. M.	70,199	76,013 K			
Oil Burned	684	484			1168
Water Meter 3 P. M.					141,963 cu
Water Meter 7 A. M.					139,863 cu
Total Water					2100

TURBINES	1	2	3	TOTALS
On		✓	✓	
Off				
Hours Run		8	8	
Steam Meter 3 P. M.		36,913	24,000	
Steam Meter 7 A. M.		34,977	24,063	
Steam Used		2V	1K	3780
Kw Meter 3 P. M.		3745	2630	
Kw Meter 7 A. M.		3715	2568	
Kw Generated		13	1K	2800
Heating Steam 3 P. M.	4994			
Heating Steam 7 A. M.	4787			
Total Heating Steam	207			1972800

Engineer — Fireman

3:00 P. M. to 11:00 P. M.

On	✓	✓		✓	✓
Off					4:30 PM
Hours Run	8	8		8	5½

Engineers

OUT DOOR TEMP	
7:00 A. M.	42
12:00 Noon	46
4:00 P. M.	38
12:00 Mid	32

OIL INVENTORY 7 A. M.	Tank 1	Tank 2	Tank 3
	24,300	28000	11300

FLUORINE TEST	Well	Steam
	1.0	7

Delivered: 1 Load Bunker C 6000 Gals 4:30 PM
1 Load " 6497 " 4:00 PM
Total

Laundry Steam	
Meter Stop	
Meter Start	No 79 Mcf
Total	
Exhaust Steam	
Meter Stop	
Meter Start	No 15 Mcf
Total	

WATER PUMPS

	No. 1	No. 2
On	7:00 PM	7:00 PM
Off	3:00 PM	4:00 PM
Hrs Run	10 Hr	10 Hr
Meter Stop	6877	
Meter Start	5200	
Gals Pumped	351,500	

Feed Pumps	1	2

WATER TEST

	Well	Steam
	6.0	

7 Sample log sheet gives an idea of the meters and controls, like feedwater treatment, now made a regular part of each shift operation. With a file of information like these logs supply it is possible to plan and meet any future power needs in time

what we didn't have rather than what we did have.

The boilers and their operation suffered from a complete lack of (1) automatic controls on oil feed, air and draft (2) boiler meters or flow-meters (3) micrometer valves for oil and steam control for the burners (4) emergency boiler feedwater supply (5) accessible boiler gage glasses (6) catwalks in the boiler room. Over and above this was a feedwater heater too small to supply the needed water at high loads.

Our troubles and shortcomings didn't stop there. They carried over into the turbine room. There the plant floundered on (1) without flowmeters in the turbine supply lines (2) with turbine supply headers so small that, at high load, pressure drop between boiler and turbine reached 25 psi, and (3) with turbine exhaust valves impossible to get at from operating floor working level.

Just how badly off we were we have no knowledge. We had no records except fuel costs. We knew nothing about our boiler efficiency. In short, we knew we needed help but just how much we could only guess.

Finally, we called in an outside consulting engineer. His first recommendation was to fit our load curve to our equipment. Fig. 3, 4 show how much that helped. Seems simple. But if you have ever tried to sell an engineering idea to bakers or laundry operators at an institution you will appreciate the job for what it is.

Our chief difficulty was the bakery load. It came on between 6:00 am and noon. By dint of heavy persuasion we shifted bakery operations from morning to afternoon. The extra baking load shows about 5:00 pm on the second curve after the usual daytime activities have ceased. Some difference from the loads in Fig. 3.

Before the change the bakery load on top of the usual daytime load strained our plant to the limit. In fact, on dark days in the summer our load has been known to hit 500 kw at 11:00 am.

Under the new loading schedule we now operate two boilers at a time during most of the year. At certain times we shut down one burner on the second boiler. A very few times we can get by on only one boiler.

We cannot operate through the day with only one 325-kva turbine-generator. It is always necessary to help out with the second. The larger 625-kva machine can just about hold its own at other times. But at last we know we can meet any load and, what's more important, we can tell when it's coming.

PRINCIPAL POWER-PLANT EQUIPMENT

Southbury Training School, Southbury, Connecticut

STEAM GENERATION:

Boilers, 4.....Titusville Iron Wks Div, Struthers-Wells Corp
Watertube, 15,000 lb per hr, 275 psi, 500 F
Burners, 8.....Schutte & Koerting Co
Two per boiler, turbine-driven
Burner drives.....Coppus Engrg Co
Controls, burner, hydraulic, automatic valve-control.....A W Cash Co
Water columns.....Ernst Water Column & Gage Co
Soot blowers, 5 per boiler, steam.....Bayer Co
Meters and instruments.....Bailey Meter Co
Valves.....Lunkenheimer Co; Reading, Pratt & Cady Div; Crane Co

PUMPS:

Feedwater, 2: Two-stage, centrifugal steam drive.....Goulds Pump Co; Pump drive, 65-hp turbines.....Whiton Machine Co
Injector, 4, one per boiler, emergency feed.....Schutte & Koerting Co
Oil, 2.....Warren Steam Pump Co
Burner fuel-heating cylinders included
Condensate, heating supply, laundry load.....Fairbanks, Morse & Co
Oil, 1, emergency, electrically driven gear pump.....Schutte & Koerting Co

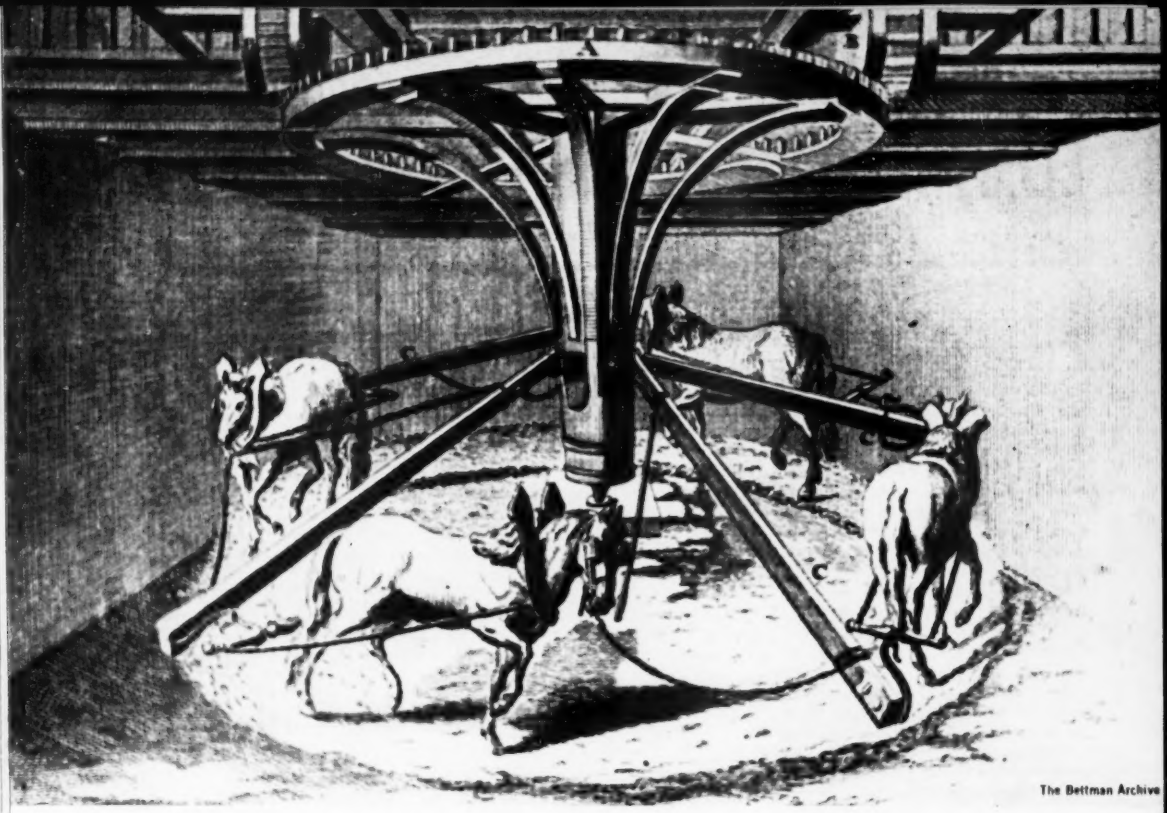
TANKS AND HEATERS:

Feedwater, 1.....Worthington Pump & Machinery Corp
10 psi, 1000 gal (40,000 lb per hr)
Return, 1, 3000 gal.....Norwalk Tank Co
Oil storage, 3 underground: 2-25,000 gal, bunker C.....Norwalk Tank Co; 1-25,000 gal, No. 5 oil.....Norwalk Tank Co

ELECTRIC GENERATION:

Turbine-generators, 2..Moore Steam Turbine Div Worthington P & M Co
375 kva, 275-psi supply, 30-psi exhaust
Generator, 2300 v, 60 cycle.....Crocker-Wheeler Elec Mfg Corp
Turbine-geenrator, 1..Mooer Steam Turbine Div, Worthington P & M Co
625 kva 275 psi, supply 30-psi exhaust
Generator, 2300 v, 60 cycle.....Crocker-Wheeler Elec Mfg Corp
Switchboards, 3, totally enclosed, 1 per generator.....Roller-Smith Co
Switchgear.....Roller-Smith Co
Crane, 1.....Wright Hoist Div, Amer Chain & Cable Co
Overhead, hand-operated, 10-ton
Voltage regulators.....Westinghouse Elec Corp
Rheostats.....Cutler-Hammer Inc

CONSULTING ENGINEER.....H B Van Zelm



The Bettman Archive

A CONTINUOUS CYCLE, like the WATER in modern ash and dust handling

This 18th Century French method of producing power with horses moving in a continuous cycle reminds one how water recirculates in modern ash and dust handling. In both cases, maximum work is obtained from the moving forces by using them over and over again. In Recirculating Hydrojet and Hydrovac, scarce and/or costly water never leaves the circuit. Only a small amount of make-up is required to compensate for water absorbed by ashes and water mixed with dust, when unloaded in cars or trucks. No water goes to sewer or waste, thus river and harbor pollution is eliminated. You can find out from our nearest representative how you can save water by using it in a continuous cycle in Recirculating Hydrojet and Hydrovac. Write us.

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ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. ***Offices & Representatives in Principal Cities***

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

17—Time-Delay Electronic Relays

► THE RELAYS we studied in the two preceding articles open or close almost instantly when their actuating impulse occurs. These are used for many purposes and reasons. When a magnetic relay is energized, the contact through which its coil's circuit is made must have low resistance to carry the comparatively large current. This is not required by electronic relays because they can be designed to operate when their actuating contact has a resistance up to 5 megohms.

Electronic Relays. The actuating contact of a magnetic relay must remain closed long enough for the current to build up in the circuit to a point where the magnetic pull can close the relay contacts and hold them closed. This may require a considerable part of a second; otherwise, relay operation may be erratic. Electronic relays are designed to close and remain closed even when their actuating contact makes for only 0.004 sec.

When the actuating contacts are very light as on a contact-making instrument the current through them must be held to a value below that which would operate a relay. Unless this is done, arcing on the contacts would soon cause them to pit and stick closed. With electronic relays a high resistance can be connected in series with the actuating contacts to limit the current through them to a few microamperes.

Relay Applications. Characteristics of these relays suit them to a wide variety of applications like signaling, testing materials, detecting seams in cloth and broken threads in looms, testing conductivity of solutions, maintaining constant temperatufe, sorting small parts, and as floatless liquid-level switches.

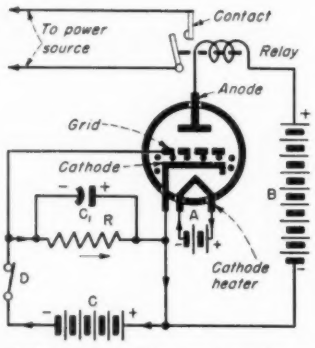
There are also many applications where a time delay is required in the closing or opening of the relay after the actuating contact opens or closes. With a magnetic relay, timing of its contacts can be obtained by an air bellows or piston, a piston in an oil cylinder, or synchronous motor-driven timers. For many applications these have limitations such as those mentioned for nontiming relays. In addition, they do not have as high a degree of accuracy as required for certain applications, especially for short timing periods or rapid repeat operations.

Timing Circuits. Electronic-timing circuits are used to control welding, annealing, brazing and other heating processes, in counting operations, motor control, door openers and closers, and for many other purposes. A short-time delay is sometimes used in electronic relays to prevent rapid operations of the electromagnetic contactors, caused by chattering or bouncing of the actuating contacts. This timing prevents the electromagnetic relay from becoming immediately reenergized after the initial opening of the actuating contact.

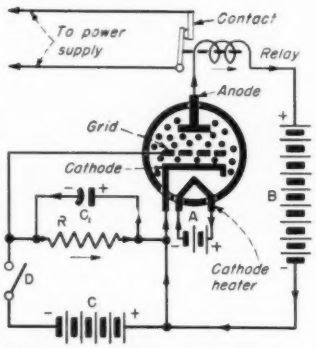
In electronic time-delay relays a capacitor connected in parallel with a high resistance usually acts as the timing element. Some of the relays previously considered can be given a time-delay in their operation by adding a capacitor in parallel with the grid resistor.

Fig. 1 is the same as Fig. 6 in July POWER, p 118, except capacitor C_1 has been added across resistor R. When switch D is closed, the grid has a minus

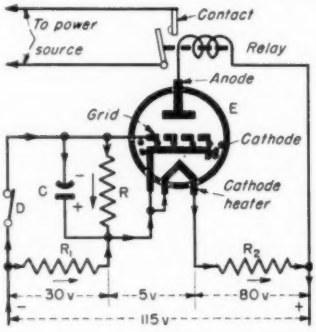
Battery and Power-Line Operation



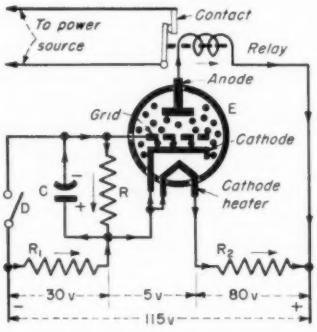
1 When switch D is closed, grid has a minus bias and tube cannot conduct



2 Opening switch D removes bias from tube; it conducts to close the relay



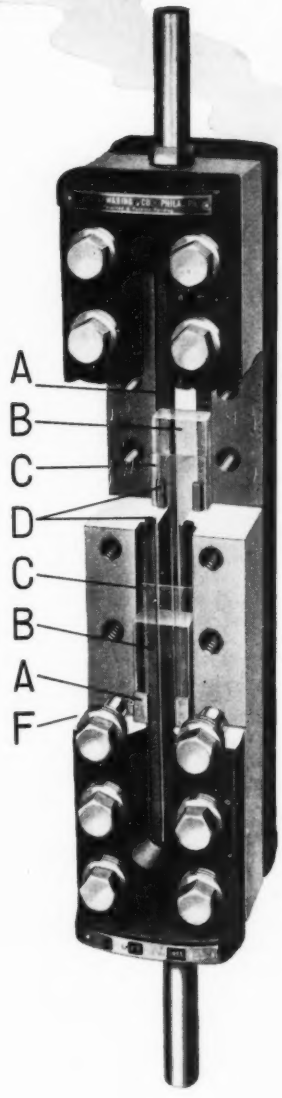
3 Resistors R_1, R_2, replace batteries, Fig. 1-2, to operate on 115-v circuit



4 With switch D open, bias is slowly removed from grid and relay closes

"Floating Assembly" Water Gage

REDUCES LEAKAGE and GLASS BREAKAGE



Yarway offers help to the steam plant engineer who has the problem of leakage and glass breakage on flat glass water gages. It's "floating assembly."

Research shows a flexible feature is required to prevent leakage and excessive loading of glasses. *Spring cones (F), under the cap nuts fastening independently adjusted covers and glasses in place, provide this flexibility.* The "floating assembly" loading is predetermined . . . is maintained by cap screws which shoulder on the insert body, limiting the spring cone compression to that required. *Front and back cover plates are independently adjusted.*

Engineers say these features help them. They may help you, too.

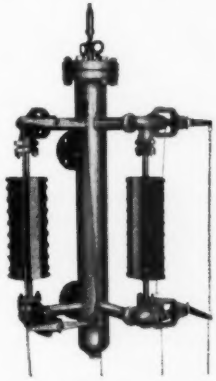
For the full story on "floating assembly" and the Yarway line of water columns and gages, send for Bulletin WG-1811. Or see a model demonstrated in your own plant. Write . . .

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.
Branches in Principal Cities

•

Cut-away section of Yarway Flat Glass Gage. Front and back cover plates are independently fastened to body by special shouldered cap screws fitted with spring cones (F) which automatically limit the pressure on glasses and gaskets and at the same time allow for expansion and contraction.

Special molded gaskets (D) provide tight pressure-sealed joints between body and glasses. Cushioned asbestos gaskets (A) are placed between cover plates and outer faces of glasses (B). Inner surfaces of glasses are protected by India ruby mica (C).

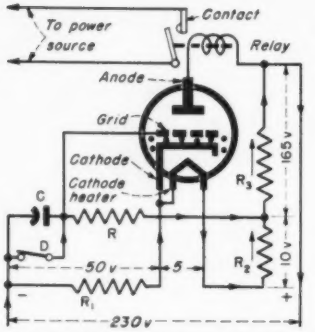


Yarway Water Column with two Yarway Flat Glass Gages. For pressures from 400 to 2,500 psi.

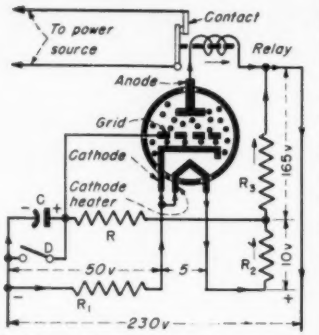
YARWAY

WATER COLUMNS AND GAGES

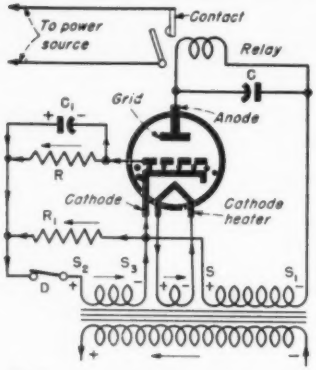
Resistor and Transformer Operation



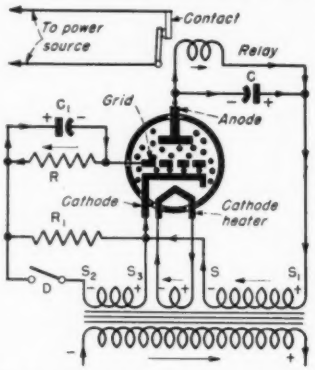
5 Time-delay relay operated from a 230-v dc circuit through resistors



6 Same as Fig. 5 but switch D is open to let relay close after time delay



7 On this ac time-delay relay, transformer secondaries replace batteries



8 Opening switch D removes the bias slowly from grid and the relay closes

bias equal to battery *C* voltage. Current flows through resistor *R* as indicated, and capacitor C_1 is charged to the polarity shown. When switch *D* is opened, Fig. 2, capacitor C_1 discharges through resistor *R* as indicated. The capacitor also tends to discharge from the grid to the cathode and maintains a minus bias on the latter so the tube cannot conduct enough current to close the relay. How long the time-delay, from opening of switch *D* to the closing of relay's contacts, depends on the capacitor's rating and the ohms resistance of resistor *R*. If these two are made large enough the delay may be several minutes.

Voltage Dividers. Fig. 3 accomplishes the same as Fig. 1 and 2 but operates from a 115-v circuit, using resistors to obtain correct grid, cathode-heater and anode voltage. The cathode is heated by a current through R_3, the cathode, and R_2. Assume the voltage divides, R_1 30 v, the cathode heater 5 v, and R_2 80 v. With switch *D* closed, the 30 v across R_1 is applied as a minus bias to the grid. This apparent circuit is from — line, switch *D*, the grid to cathode, R_2 to the + line. Current flows through *D* and into capacitor *C* to charge it to the polarity indicated. Under this condition amplifying tubes *E* cannot conduct and the relay remains open.

With switch *D* open, Fig. 4, capacitor *C* discharges through *R*. It also tries to discharge from the grid to the cathode, and keeps the former at a minus potential until the capacitor discharges. Resistance of *R* is very high so the capacitor discharges slowly.

Several seconds may elapse before the capacitor's voltage and the resulting grid bias drop to where tube *E* can pass sufficient current to close the relay. Here again the capacitor serves to delay the closing of the relay.

Fig. 5 is a third dc-circuit arrangement to delay closing of the relay, but on a 230-v power supply. As in Fig. 3 and 4, correct grid, cathode-heater and anode volts are obtained by resistors R_1, R_2 and R_3. Delay in closing the relay is obtained during the time that capacitor *C* charges rather than when it discharges, as in the previous diagrams. Closing switch *D*, Fig. 5, short circuits capacitor *C*, so it remains discharged.

When cathode-heating current flows through resistors R_1, R_2 and R_3 assume that voltage drop across each resistor is as shown. This puts a minus bias of 50 v on the grid from — line, switch *D*, the grid and cathode to R_2, so that the tube cannot conduct. A potential of 65 v exists across resistor *R* from — line to between resistors R_2 and R_3, and current flows as indicated. This circuit will be given further study later.

Opening switch *D* puts capacitor *C* in series with resistor *R* and it charges in a circuit from — line, *C*, resistors *R* and R_2 to the + line. Capacitor *C* and its resistor *R* are connected in parallel with resistor R_1, the cathode and R_2. Consequently, the capacitor is charged to a voltage equal to that across these three elements or $50 + 5 + 10 = 65$ v.

At the instant the capacitor starts to charge the grid still has a minus bias of 50 v, the same as before switch *D* was opened. As the capacitor charges current flows through it and resistor *R* decreases, until when *C* is fully charged no current flows through *R*. Volts' drop across this resistor then becomes zero, likewise the minus bias on the grid. This permits the tube to conduct and close the relay.

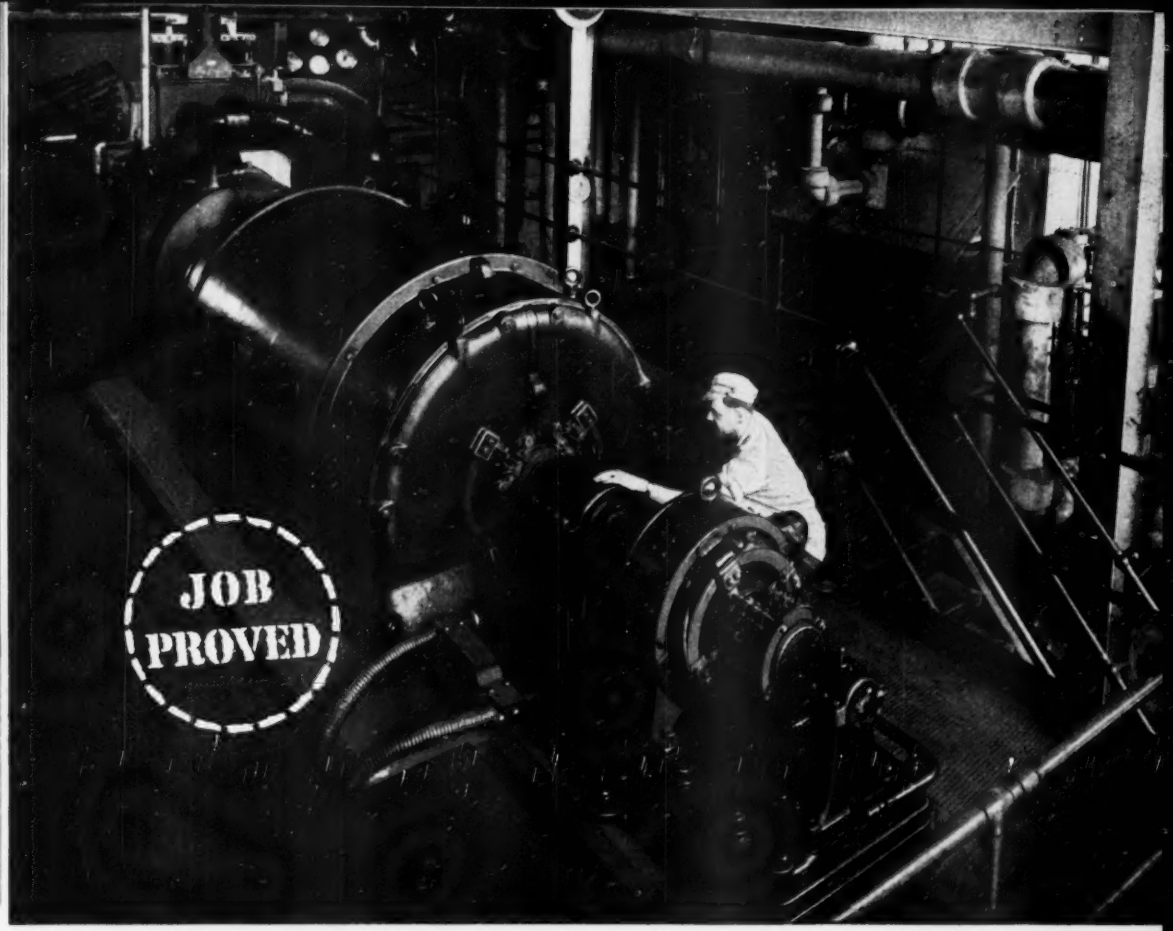
With these connections a delay of 10 sec or more can be had from the time of opening switch *D* and the relay closes. The time depends on the capacitor's rating and the ohms resistance of *R* as in the other relays. The latter is usually several megohms.

Plus Bias on Grid. When capacitor *C* is charged, current ceases to flow from it through resistor *R*. But this resistor is still connected from the grid to between R_2 and R_3. This applies the voltage across R_2 and the cathode heater, $10 + 5 = 15$ v from cathode to the grid. That is, the grid apparently has a plus bias of 15 v. This circuit is from the cathode to the grid, resistor *R* and to between R_2 and R_3. Resistor *R* in series with the grid, however, has a resistance of several megohms.

The high resistance has an effect that holds the grid bias close to zero. Therefore, anode current will not increase beyond that obtained with zero volts on the grid. This is because the volts' drop across resistor *R* is practically equal to the total plus bias.

For example, if we assume that resistor *R* has 5 megohms resistance and the total 15-v bias is applied across the resistor, the grid current is $15 \div 5{,}000{,}000 = 0.000003$, or three millionths of

(*Continued on page* 160)



PROTECTED BY SUNVIS 916

Turbine Bearings and Journals Corrosion-Free Despite Summer Shutdowns — Oils Like New After 9,000 Hours

Three years ago, a paper mill overhauled a steam turbine. Thereafter, it was planned to operate this equipment on a 'round-the-clock schedule during the six winter months, and completely shut down in the summer. On the advice of a Sun Engineer, the mill charged the circulating system supplying turbine, generator journals, and governor with Sunvis 916. This oil was chosen because of its "Job Proved" ability to prevent rust and corrosion and to give troublefree lubrication for a long period of time.

The management's selection of Sunvis 916 proved to be sound. After 9,000 hours, a laboratory analysis of the oil showed it to be unchanged—comparable to a sample of new oil. Even more important, inspection showed no abnormal wear and no corrosion in bearings and journals, despite the summer-long shutdown.

The turbine has now operated 12,000 hours without oil-change, and it appears that none will be necessary in the foreseeable future.

All oils in the Sunvis 900 series have a high viscosity index, are fortified against oxidation and sludging, and prevent rust and corrosion. Sunvis 900 Oils are the finest lubricants available for turbines, hydraulic systems, and similar applications. For a free, illustrated booklet on Sunvis 900 Oils, write Department **P-9.**

SUN OIL COMPANY • *Philadelphia 3, Pa.*
In Canada: Sun Oil Company, Ltd.
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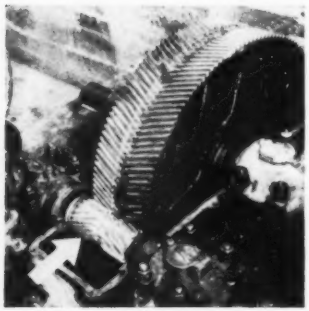
SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

SUNOCO

POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

GEAR REBUILT BY WELDING PREVENTS PLANT SHUTDOWNS



AN AKRON RUBBER PLANT uses a 150-hp motor to drive four rubber mills through speed-reducing gears. Recently the 10-in.-wide pinion broke a tooth, making further operation impossible. Since a new part could not be delivered before 30 days it was decided to rebuild the gear by welding.

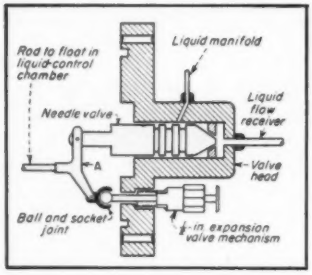
The welding alloy has to be tough, hard and strong, and machine easily. The application heat must be as low as possible to avoid distortions. A Eutectic weldrod, BronzoChrom 185FC, was used for the job. First, the pinion was machined down to just below the teeth roots. Rebuilding began with cleaning and fluxing. Then with the flame cone about ¼ in. from the metal the oxyacetylene torch was kept in constant motion over the starting point until the flux melted. This signaled the exact time to begin overlaying.

The torch was held at a low angle to control and flow an axial bead. Passes were spaced regularly around the circumference to avoid local heat concentration and distortion. After the surface was completely covered with a thin layer of weld metal, additional deposits were made in wide beads with a weaving torch motion until the outside diameter was slightly larger than finished pinion dimensions.

When the work had cooled a new 16-tooth herringbone pinion was cut as shown in the photo. Upon reassembly the gear unit ran perfectly. With 20 lb of weld metal the mills were back in operation in three days, and at less than half the cost of a new part replacement.

The weld metal is stronger than ordinary bronze and has a low coefficient of friction when working with iron and steel. The rebuilt pinion will probably last longer than a new part.

REDESIGNING REFRIGERATION VALVE SPEEDS ADJUSTMENT

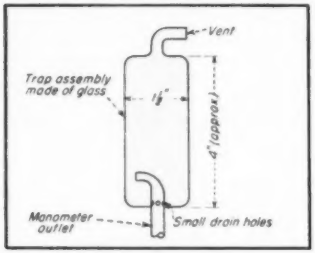


SOON AFTER INSTALLING a 15-ton fast-freezing ice tank with an automatic liquid valve we found it necessary to readjust the valve to produce the required tonnage. To do this, the valve body had to be pumped out and dismantled. The original setup had a threaded pin, which screwed into the valve head, and had a locknut to keep it in position. This pin acted as the fulcrum for lever *A*, see sketch, which is now replaced by the ball-and-socket joint. Adjustments were made by screwing this pin in or out, in this way regulating the needle movement for a given float stroke.

In rebuilding we drilled and tapped the flange of the automatic valve body to take the threaded end of an expansion valve as in the sketch. The end of the valve stem was drilled and tapped to take the threaded end of the ball stem. The socket stem was filled to fit the fork in lever *A*. A small handwheel was fitted on the expansion valve mechanism because of the restricted clearance.

D J PARMER *Quincy, Fla.*

TRAP RETURNS MANOMETER OVERFLOW



WE ALSO HAVE a manometer overflow problem, like the one mentioned in your June Notebook. Instead of a flask we use a trap that catches the overflow and automatically returns it to the manometer, see sketch at left. A glassblower can make these traps easily, or patented variations may be bought for about $1.50 from most laboratory glassware manufacturers. These traps lose practically no fluid.

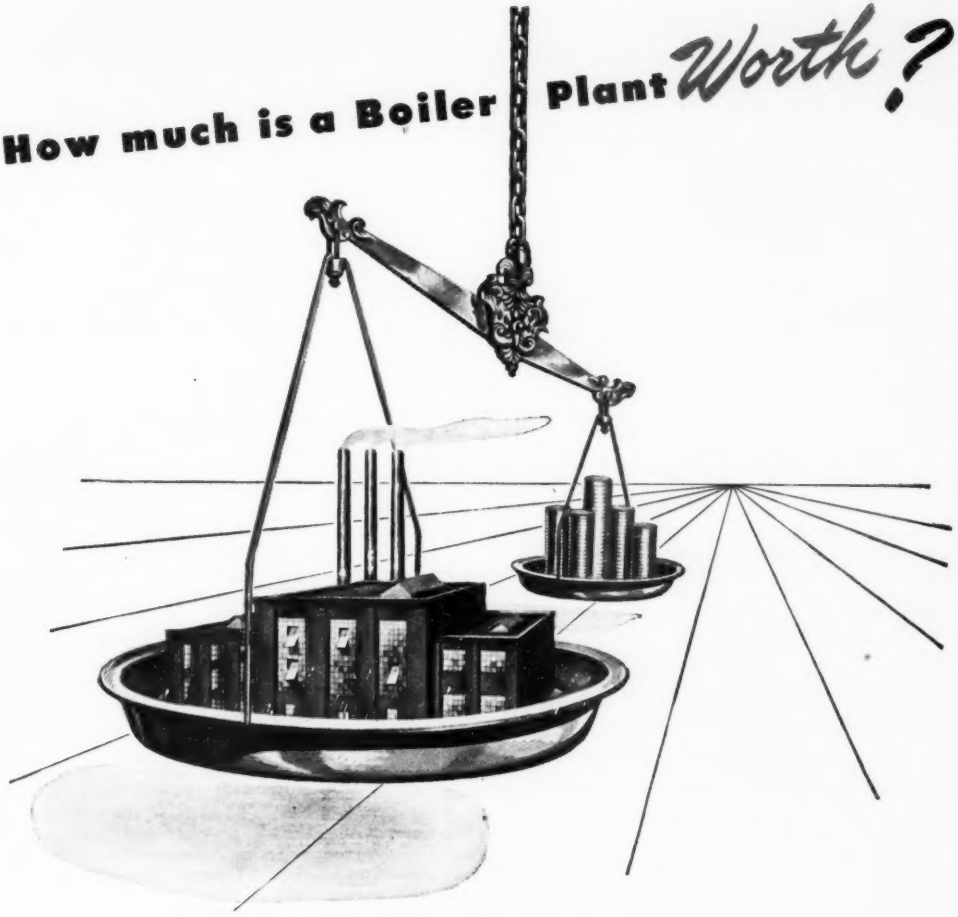
M M ANDERLE *Marinette, Wis.*

The Editors Invite Contributions From POWER Readers

Here's your chance to cash in on one of those professional tricks you have used in your plant. POWER pays $20 for each item published here on problems in design, operation and maintenance. Your contribution need be in rough form only—just set down all facts with sketches in pencil. We will do any editing that is needed.

CONTINUED ON PAGE 132

How much is a Boiler Plant *Worth?*



A boiler plant may *cost* up to any figure you wish to name.

But a boiler plant's *worth* depends entirely upon how efficiently it operates. For instance, how many or *how few* shut-downs you have may depend entirely on the effectiveness of your water conditioning service.

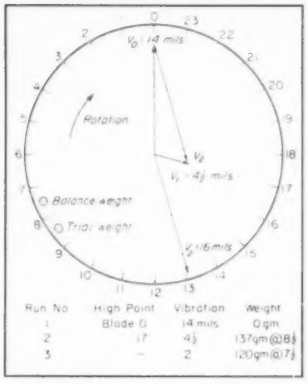
Correct water conditioning is a matter of careful and scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical. Our staff of engineers will welcome the opportunity of discussing your boiler water problems . . . W. H. & L. D. BETZ, Gillingham and Worth Sts., Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

HOW TO BALANCE ROTATING MACHINERY QUICKLY


V_0 14 mils
Rotation
V_2
V_1 4½ mils
Balance weight
Trial weight
V_2 16 mils
Run No. | High Point | Vibration | Weight
1 | Blade 0 | 14 mils | 0 gm
2 | 17 | 4½ | 137 gm @ 8½
3 | — | 2 | 120 gm @ 7½

TIME NEEDED FOR balancing rotating machinery can be shortened by a simple calculating procedure. Cut-and-try methods usually involve a large number of runs. These can be cut to three in most cases by using a simple vector drawing.

First, find the high spot and vibration amplitude at each bearing with the rotor in original unbalanced condition. The high spot can be found by scribing the shaft or by a stroboscope with dial indicator. The high point will be at the center of the scribed mark on the shaft or at the stroboscope setting for a maximum reading on the dial indicator.

Vibration amplitudes can be read with a dial-indicator type vibrometer or with the light-beam type. The reading must be made carefully as the calculations depend on the change in vibration amplitude. It is usually best to find the high point and amplitude in the horizontal direction. Most machines have greater movement horizontally, increasing the reading accuracy.

Calculations are made with vectors. A vector is a line drawn to scale representing size and direction of the vibration. The vibrometer gives the size or amplitude. The direction is the angular position of the high spot from an arbitrary reference point on the shaft.

Sketch shows the solution for an outboard bearing of a 300,000-cfm 1100-rpm induced-draft fan. A similar drawing would be made for the other bearing. With data from the first run draw a vector for each bearing. The vector V_0 in the sketch is the original condition, 14 mils at blade No. 0. The high point can be given as an angle from a reference point, such as a balance-plug hole number, etc.

Then select a trial weight for each end of the rotor. The size depends on size and speed of machine and vibration amplitude. A trial weight of 5 or 6 oz is about right for this fan with 15-mil vibration. The same size weight works well with a 3600-rpm 500-kw turbine with 2 to 3 mils vibration. Low-speed machines require more weight than high-speed units.

The weight should be more than 180 deg ahead of the high point in direction of rotation. An angle of 190 to 240 deg should be used for machines running below their critical speed; and 280 to 300 deg for machines above critical speed. The builder can usually furnish information on critical speed. In this case a weight of 137 gm was placed between blades 8 and 9, see sketch.

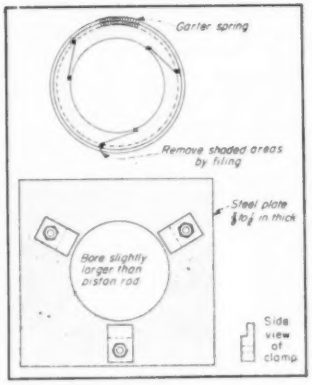
Next a second run is made with same load and speed as the first run. The high-point position and amplitude is then plotted as vector V_1. Then draw a vector from the tip of V_0 to V_1. This vector V_2 represents the effect of the trial weight. Move V_2 parallel to itself so it starts at the center of the circle. It is found to have an effect of 16 mils at blade No. 13. To balance the outboard end of the rotor this vector must be made equal to 14 mils at blade No. 12, or equal and opposite to the original vector V_0. To get this condition, V_2 must be shifted one blade clockwise. This can be done by moving the balancing weight one blade in the same direction. To find the correct balance-weight size multiply the trial weight by the ratio of V_0/V_2, or $137(14/16) = 120$ grams. Its correct position will be between blades 7 and 8.

Finally remove the trial weights and place the two new weights in the rotor. The rotor should balance at this point, but it frequently is necessary to make another run using the two calculated weights as trial weights. This is particularly true if considerable change was made from the size or position of the trial weights. In the example, only a small change was made and the final vibration was only 2 mils.

It is not necessary to balance each end of the rotor independently as sometimes recommended. The effect vector, V_2, actually includes the effect of both weights. Hence, a large change in either weight will affect the accuracy of results.

A S GRIMES, JR *Logan, W. Va.*

TIPS ON PROLONGING LIFE OF PISTON-ROD PACKING


Garter spring
Remove shaded areas by filing
Steel plate ⅛ in. thick
Bore slightly larger than piston rod
Side view of clamp

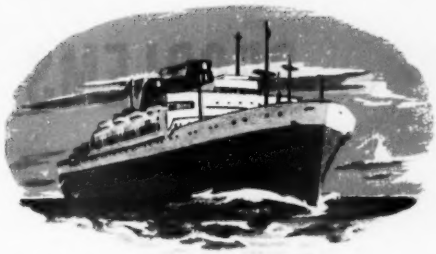
IF METALLIC PACKING RINGS around a piston rod show leakage or wear they are usually replaced with new ones. However, they can be reconditioned for extended service. As shown in the sketch, carefully file the ends of the packing sections an equal amount until they close to a diameter smaller than that of the piston rod. Then clamp them to the plate, which is held in a lathe chuck and centered for boring. Bore the ring sections for a running fit on the piston rod. Remove all sharp edges with a half-round file or scraper. This is important; otherwise the sharp edges may scrape oil film from piston rod before rings become properly seated, causing trouble.

A job done in this manner is often more satisfactory than installing new packing of standard bore.

Shoulders on piston-rod ends are not unusual, particularly next to the piston on double-acting gas engines. Rods at this point are exposed to high temperatures, which tend to break down rod lubrication. It is advisable to remove these shoulders for a distance of at least ½ in. so they will not strike packing rings. It is not necessary to place the piston rod in a lathe. This can be done with a fine flat file, finishing with a fine oil stone. For badly scored, tapered or out-of-round piston rods, turn them true, polish, and then install new undersized packing rings.

R E FONTAINE *Kenmore, N. Y.*

1. Before pulp becomes paper, long, trim lines of copper tube have conveyed pulp, stocks, "white water" and just plain water.



2. Engine rooms of great steamships are a maze of copper tubes carrying steam, hot water, cold water, sea water, fuel oil, and lubricating oil.

3. Copper tubes, more than any other kind of piping, form the "production lines" of the chemical and pharmaceutical industries.

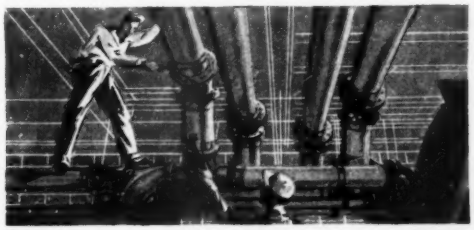
4. At the brewery, beer leads a sheltered life in immaculate copper equipment. Both wort and beer flow with impunity through copper tube lines.

Where rust won't do . . .

COPPER will!

WHETHER you write a letter, read a book, drink a glass of beer, raid your icebox, turn on your oil burner, ride in a motor boat or an ocean liner, copper tubes are serving you. And when you take a pill, chances are that copper tubes helped to make it . . . and to fill your glass with water, too!

All-in-all, millions of feet of copper tubes, of many sizes and types, are at your service right this minute . . . and more of it carries the Anaconda name than any other.



Anaconda Copper Tubes

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General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont*

PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

WHAT ABOUT USING NO. 6 FUEL FOR DIESELS?

A YOUNG SALES ENGINEER dropped into my office last week and outlined several methods by which we could cut plant costs. Among the items he suggested were these two:

1. Use of No. 6 oil for diesel fuel. The cost of such "boiler oil" is roughly half that of the usual diesel fuel.

2. He also mentioned "high-temperature" cooling. In this scheme, the engine jackets operate under slight pressure (about 5 psi in some cases) and at temperatures above 212 F (up to 240 F, say). Jacket water can be flashed to steam, which can be used for process. Don't confuse this with waste-heat boilers used with engine exhaust. In addition to advantages such as more uniform temperature conditions in the engine block, lower friction horsepower and less cylinder-liner wear, it is claimed that about 3.5 to 4 lb of steam is produced per hphr.

Right now we're somewhat up in the air. We'd like to hear from POWER readers who've had experience with either of these suggestions. What are the results? What changes in engines, piping and plant details are needed to apply them?—*AH*

READERS' ANSWERS

Is Water Leak in Pump Valve or Piston Packing?

(This question is from June issue with best answers from readers.)

We are running into some trouble with a direct-acting steam pump in our plant. Within the last few weeks we have noticed it has failed to deliver its full capacity yet it continues to run at rated speed. From these symptoms, good common sense makes us believe either the valves or the piston packing is leaking.

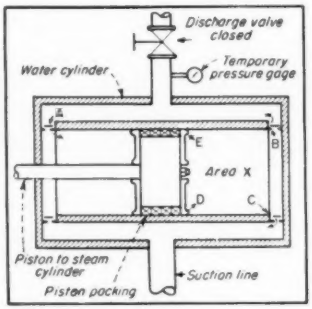
The thing that has us stumped is how to tell which of the two is causing the trouble. Can a slip test be used to give the answer? While we are at it, what is a good procedure to follow in making a slip test and what precautions must be kept in mind to prevent damaging the pump while making the test?—MO

Check Valve Seating

MO SHOULD FIRST CHECK for an obstruction in pump's suction line. He can do this by inserting a vacuum gage in the suction line close to pump; gage will read low if line is blocked. Then examine piston packing for signs of actual contact with cylinder walls. Double check that packing fits tight in piston grooves to assure water is not passing under packing. Next step is to look over both suction and discharge valves, making sure they seat properly.

To run a slip test, insert a relief valve in the discharge line close to the pump. Shut off the discharge after setting the relief valve a few pounds higher than actual discharge pressure. Let pump build up the discharge pressure, then check to see whether valves hold after shutting down pump.

F A BUTLER *Dallas, Tex.*



Slip Test Will Tell

TO MAKE SLIP TEST, *MO* should just close pump discharge valve after making sure pump is primed. Then install temporary pressure gage, as in sketch. Next, open steam valve just enough to raise gage pressure to ordinary operating value.

Pump should run about 30 or 40 times its regular speed. If all strokes of pump are equal, chances are *MO's* piston packing is faulty (*E* and *D*). But if pump slips or jumps on forward stroke, suction valve on compression is faulty.

In making a slip test, control of discharge pressure is necessary. Do this by regulating steam input to engine. Sufficient pressure can be developed to burst or even crack cylinder.

D L PARMER *Quincy, Fla.*

Is Water Flashing?

THERE ARE SEVERAL REASONS why *MO's* steam pump may not be delivering full capacity. If he is pumping hot water, or condensate returns and temperature of his return is higher than usual, he may be flashing off some of the steam, thus cutting down pump capacity. I suggest he open up the pump and clean out valves. Check cylinder bore.

It is doubtful if slip test will build up enough pressure to do any harm to pump or piping. *MO* could pump into an open container and check pump discharge against the theoretical, and get pump efficiency. About 60% is a good efficiency.

F D RAPHAELIAN *Bklyn, N. Y.*

Remove Cylinder Covers

DIRECT-ACTING STEAM PUMPS have a way of showing their defects by either racing, slowing up, speeding, or stopping entirely. Pump in question runs at rated speed and fails to deliver full capacity. This would indicate possible short stroking caused by defective valves or improper valve setting. Slippage at water end is sum of losses from water leakage past piston packing, leakage at stuffing boxes, delayed action of valves and defective valves. It is difference between actual volume discharged and plunger displacement (volumetric efficiency).

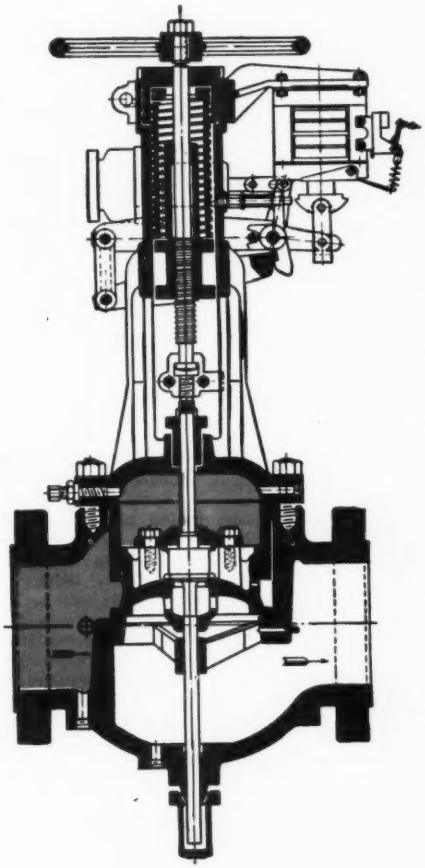
To tell whether piston packing or pump valves are defective, start pump and close pump discharge valve slowly.

(Continued on page 136)

an sk "reason why"

acts instantaneously

in an emergency



An sk Instantaneous Closing Trip Valve . . .

Acts in case of emergency . . .
When installed in the main steam header end . . .
For emergency shut down of entire steam plant . . .
By automatic or remote manual control.

It closes in less than one-third of a second . . .

Without damage to valve or pipeline.

When danger threatens, this sk Valve . . .

Closes upon rupture of long steam mains . . .
Shuts-off the turbine upon overspeed . . .
Loss of load or low oil pressure.

sk Instantaneous Closing Trip Valves . . .

Are available in many designs . . .
For various locations . . .
And piping arrangements . . .
For all operating pressures and temperatures.

You can get complete details . . .

By writing for them—today.

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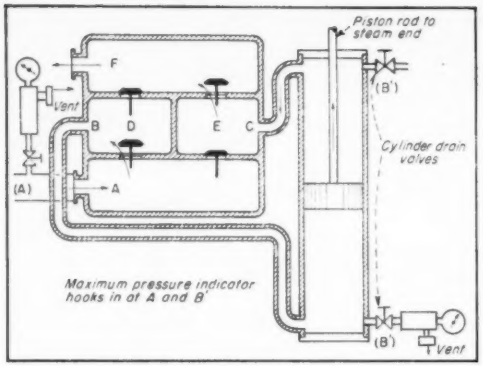
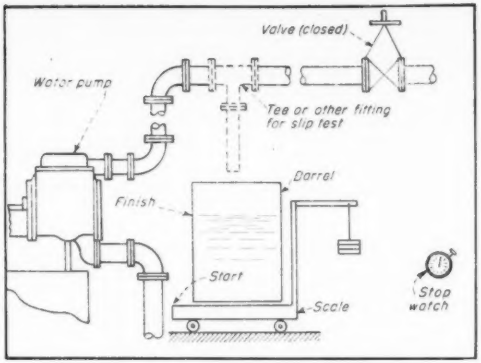




Watch pressure on gage at discharge side. Quickest way to spot the trouble is to remove water cylinder covers and examine suction and discharge valves.

J M GORRIE *Charlotte, Mich.*

Test for Poor Packing

TO TELL WHETHER packing is in good order, *MO* should first close discharge valve near pump. Then let plunger make a complete stroke. If plunger stops of its own accord it is well packed.

There is no danger of damaging pump or auxiliaries since pump valves and gaskets should be able to withstand the additional pressure.

C A WILKES *Oaklyn, N. J.*

Gage Does Trick

A SLIP TEST TELLS if there is a leak but does not show up its source. General recommendation to determine tightness of valves and plunger packing is to apply specified discharge pressure and observe leakage through a handhole or manhole on suction side, and then repeat for discharge side. All the above entails disassembly, outage and additional test equipment and separate pressure source.

My suggestion for testing suction valves is to use a maximum pressure indicator. Attach it to pump's suction chamber at point *A* on sketch above. Run pump normally or at maximum safe speed. If maximum suction is greater than normal suction pressure, suction valves are leaking.

To test discharge valves, attach maximum pressure indicator to cylinder drain connection at *B'*. Leave drain valve closed. Slow down pump and maintain highest discharge pressure by throttling discharge. When pump has almost stopped, close discharge valve and steam throttle. Open vent valve on instrument and cylinder drain valve. When pressure falls to that of suction pressure, close vent valve on instrument. If pressure builds up again discharge valves are leaking.

If both suction and discharge valves prove to be tight, it is safe to conclude that piston packing is source of leakage.

J T FITZPATRICK *Morristown, N. J.*

Slip Calculation

EXTENSIVE PISTON LEAKAGE can be heard by placing ear to pump chamber. To check amount of leakage apply on one side of piston, water pressure equal to working pressure. Leave other side of piston open for inspection. This can be done by closing stop valve in discharge line and removing disharge valves.

To test suction valves, disconnect suction line so leakage can be seen. Fill discharge line or if it has a valve, close it. Pump water into pump cylinder with small force pump (up to working pressure). Discharge valves can be checked in similar way.

A slip test can be used to check leakage. First calculate pump displacement, which is equal to mean area times length of stroke. This is the theoretical pump discharge. From this subtract actual discharge of pump. The difference expressed as a percentage of theoretical discharge is called the slip. As a formula:

$$S = 100\,\frac{D - d}{D}$$

S = slip in percent
D = theoretical discharge
d = actual discharge

Slip in a pump that is well cared for should not exceed 3%. If slip exceeds this, pump is in poor condition and should be overhauled.

F J HERZINS *Tyrone, Pa.*

Still Another Method

MO CAN DETERMINE amount of valve leakage by (1) applying normal discharge pressure, sketch above, to discharge line using external source and (2) removing cylinder head on suction side of valve being tested to see where leakage occurs. Piston-packing leakage is found by removing discharge valves and applying normal pressure from another source. Where leakage is excessive regrind valves or replace plunger packing.

With moderate suction lift and vertical discharge line, slip test shows up leaky valves or piston packing. Small suction lift and long horizontal discharge line can, under some conditions, produce negative slip. Hence use slip test for only moderate lift with vertical, or nearly so, discharge line.

To perform slip test connect discharge line to barrel and operate pump at normal capacity until barrel is full. Keep record of starting and finishing time. Difference between volume displaced by pump plunger per minute and volume of fluid discharged to barrel per minute divided by plunger displacement per minutes is slip. Slip for good operation should not exceed 3 to 5%.

TYLER G HICKS *New York, N. Y.*

Test Procedure

MOST STEAM PUMPS have a tapped hole in top of water end. To test for leaky packing stop pump, close suction and discharge valves, then remove this plug. Attach valve to opening in top of pump and leave valve open. Then open suction valve and start pump.

While pump is running slowly, close valve on pump top. If piston packing is in good shape, pump should slow down to *stop* position.

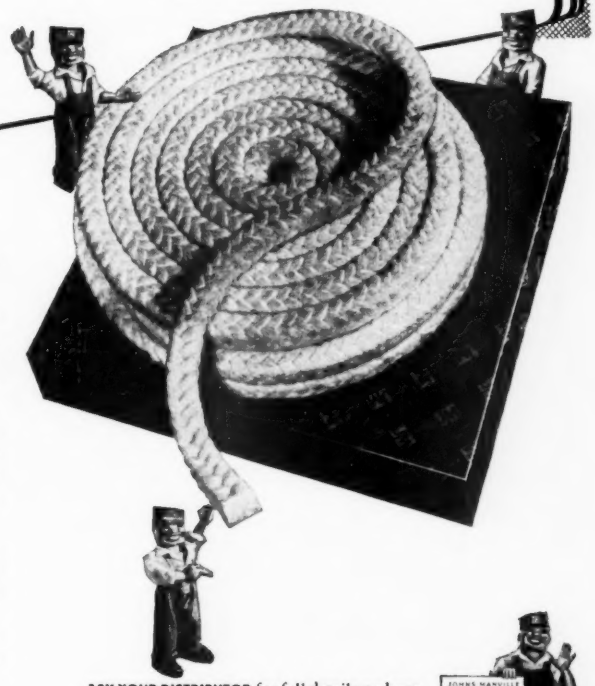
(Continued on page 166)

A Performance report from Connecticut

NAVALON PACKING

"Best packing we ever used..."

"Seven weeks ago Navalon was installed on a salt water pump operating 18 hours a day in this Connecticut power plant. It's still going strong. Longest service previously obtained from flax: 14 days. 'Navalon is best packing we ever used,' states customer."



Typical case histories show J-M's new ramie fiber packing lasts longer!

FROM PLANT AFTER PLANT across the country come workaday records—such as the one above—confirming the outstanding performance of Navalon, J-M's new ramie fiber packing for cold-liquid service.

There are good reasons for this. Ramie is nature's strongest, toughest fiber. It is exceptionally resistant to rot and deterioration. And alone of all the natural fibers, its strength actually *increases* when wet.

Add to this the fact that Navalon is made by an exclusive Johns-Manville process which forms these inherently strong ramie fibers into a packing with unique lubricating properties—and you have the secret of its long life. Exhaustive tests have shown that Navalon not only contains more lubricant to begin with, but more important, it retains its lubricant in service. That means longer wear for the packing—but less wear on rods and plungers.

ASK YOUR DISTRIBUTOR for full details on how Navalon can help you keep your packing costs down to a new low. Or write Johns-Manville, Box 290, New York 16, N. Y.

Johns-Manville *Packings and Gaskets*

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENT HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

FUELS AND FIRING: Atomization of Liquids by a Rotating Cup

HEATING AND AIR CONDITIONING: Pressure Loss and Air-Flow Characteristics of a Box Plenum • Ground Temperatures as Affected by Weather Conditions • Heat Gains Are Not Cooling Loads—A Discussion of Rates of Heat-Energy Emission from Various Sources

SMOKE ABATEMENT: Smoke and Fumes Abatement in the Oil Industry • Solid Fuel Industry's Contribution to Air-Pollution Prevention • A Smoke Official Looks at the Stoker

Directions for ordering papers are given on page 140

FUELS AND FIRING

ATOMIZATION OF LIQUIDS BY MEANS OF A ROTATING CUP, *by J O Hinze and H Milborn, "Delft" Laboratory, Royal Dutch/Shell Group, Holland.* Use of a rotating cup in burners for domestic heating is well known. But there is little or no information on the disintegration process. So the authors' company resumed an investigation it had begun before World War II to apply the rotary cup to domestic-oil burners having relatively small delivery rates—around 1 gph.

Although generally a more-or-less stray blast of air in the axial direction past the cup goes through a rotary burner the investigation has been run without any forced-air flow.

Liquid is supplied through a stationary tube to the inner part of a rotating cup widening toward a brim. Fig. 1. This liquid flows viscously in a thin layer toward this brim and is then flung off, all by centrifugal action. The flow pattern within the layer, as well as the disintegration of the fluid under centrifugal force, was the subject of considerable experiment and theoretical analysis.

A formula is derived for the thickness and radial velocity of the liquid layer within the cup. Experiments bear out the formula. Three distinct types of disintegration take place around and beyond the edge of the cup by state of (1) direct drop formation (2) ligament formation (3) film formation. Which one takes place depends on working conditions of the cup.

To go from one state to the next—drop to ligament to film—needs only an increase in quantity of supply, angular speed, or a decrease in cup diameter, an increase in viscosity, in density, or a drop in surface tension of the liquid.

Experimental results of these studies have been expressed in relationships between dimensionless groups. For the ligament formation state, a semi-empirical relationship has been derived between number of ligaments and dimensionless groups determining the working conditions of the cup.

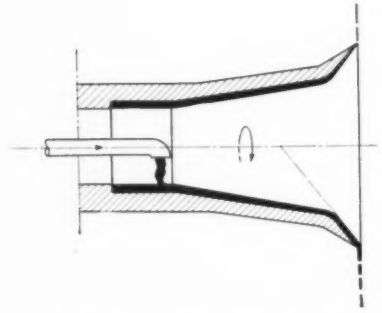
Results of drop-size measurements made for the states of ligament formation and film formation show that atomization by mere rotation of cup is much more uniform than is commonly achieved with pressure atomizers. *ASME Paper No. 49-SA-2.*

AIR CONDITIONING

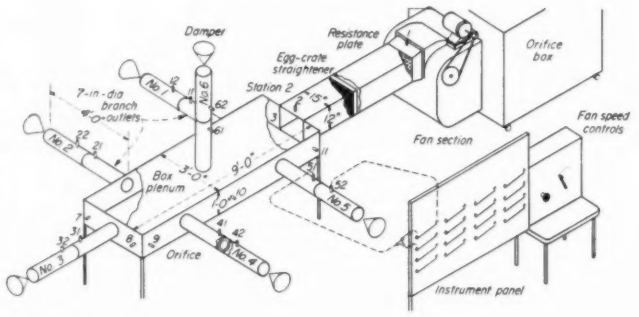
PRESSURE LOSS AND AIR FLOW CHARACTERISTICS OF A BOX PLENUM, *by S F Gilman, R J Martin, W R Hedrick, S Konzo, University of Illinois.* Box plenums are often used as central air-distributing compartments for individual ducts when located in (1) attics, in conjunction wtih either overhead supply or ceiling panel systems (2) ceilings of halls or closets in basementless homes (3) basements when the conditioner is not centrally located or the basement height is not sufficient to accommodate a bonnet.

The box plenum refers to a plenum with a large cross-sectional area relative to the inlet area, Fig. 2. Design of such plenums is hampered by lack of information. There are no data, for instance, on evaluating: (1) turbulent mixing of air in a plenum (2) effect of number, size and location of outlets on the performance of a plenum (3) effect of physical dimensions of a plenum, such as length, on pressure loss and air-flow characteristics.

To supply some of this information the authors ran a series of tests. They set up a box plenum with six branch



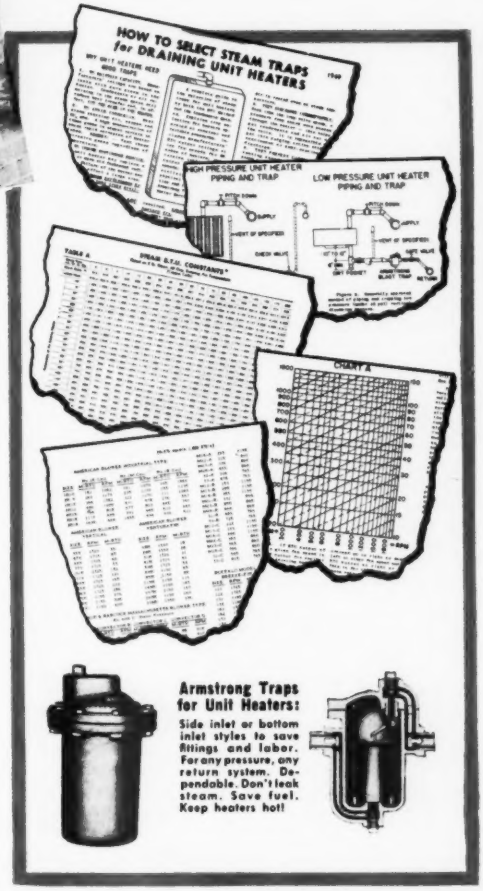
1 Oil in any rotating-cup burner flows toward the brim and is flung off edge



2 Orifice box, right, measures air quantities entering the test system by way of centrifugal blower, then through duct into a sample-box plenum undergoing tests

HOW TO SELECT UNIT HEATER TRAPS

1. To obtain full BTU output
2. To insure continuous service
3. To avoid corrosion


HOW TO SELECT STEAM TRAPS for DRAINING UNIT HEATERS
HIGH PRESSURE UNIT HEATER PIPING AND TRAP
LOW PRESSURE UNIT HEATER PIPING AND TRAP
Armstrong Traps for Unit Heaters:
Side inlet or bottom inlet styles to save fittings and labor. For any pressure, any return system. Dependable. Don't leak steam. Save fuel. Keep heaters hot!

THE ANSWERS are in a new 8-page handbook prepared by Armstrong! Only thing of its kind, this manual explains why it is important to use dependable traps that are properly sized and that will discharge condensate and corrosive incondensable gases at steam temperature; tells how to select traps by the BTU Method and the Condensate Weight Method; includes tables of BTU outputs of the heaters produced by 24 different manufacturers; discusses heater manufacturers' recommendations on types of traps to use and methods of installation; and includes tables and charts for working trap selection problems.

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outlets. Five separate entrance sections were used. Fig. 2 shows the test system. An orifice box measured the quantity of air entering the system. A centrifugal blower discharged air from the orifice box into the trunk duct leading to the box plenum. Two adjustable rheostats provided for speed variation over a wide range. A resistance plate and egg-crate straightener gives uniform flow conditions at Station 2.

Performance, flow quantities, pressures, etc, for the different entrance sections and the six branch outlets make the subject matter of this paper. *ASHVE paper. No number.*

GROUND TEMPERATURES AS AFFECTED BY WEATHER CONDITIONS, *by A B Algren, University of Minnesota.* Ground-temperature data on the various soils for different climatic conditions are becoming increasingly important in many phases of heating, ventilating and air-conditioning engineering. Some of the more recent developments for which these data have direct application are: (1) the earth as a heat source for the heat-pump application (2) perimeter and ground slab loss for floor panel-heating systems (3) ground losses together with floor-slab temperatures for basementless houses where other heating methods exclusive of floor panel systems are used.

Over a 2-year period a 110-acre plot was used as a test area. Soil temperature to a depth of 16 ft was measured by thermocouples. Soil examined was of silt and clay, at some points bare, and at other points covered with sod. Insulating effects of the sod were quite noticeable. Average temperature difference between the bare and sod-covered soils was 7.6 F for Sept at 1-ft depth, progressively decreased to a 3.6 F difference at 16 ft. Between Sept and April, air temperatures affected thermocouples in the bare ground more than those in the sod.

Another interesting observation in this paper is that the ground at 16 ft is warmest in Nov and coldest in April. This condition is due to a time lag and is described in the author's illustrations. *ASHVE paper. No number.*

HEAT GAINS ARE NOT COOLING LOADS, *by C O Mackey and N R Gay, Cornell University.* Cooling loads are commonly calculated as if the energy transferred from lights, appliances, occupants and warm surfaces and through glass found its way into the air immediately and without reduction. Part of this energy transfer is radiant, and part convection. If remote surface cooling of the conditioned air is used (cooling coils or spray chambers) only the convection energy is an immediate and direct cooling load.

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources: American Society of Heating and Ventilating Engineers, midyear meeting, Minneapolis, Minn. June 21-23, 1949. Papers are identified by initials ASHVE. Obtainable through ASHVE, 51 Madison Ave., New York 10, N. Y.

American Society of Mechanical Engineers, semiannual meeting, San Francisco, Calif., June 27-30, 1949. Papers are identified by initials ASME and paper number. Available through ASME, 29 W 39th St, New York 18, N. Y.

Smoke Prevention Assn of America, 42nd annual meeting, Birmingham, Ala. May 23-27, 1949. Papers identified by initials SPA. All papers published in bound volume through C D Behan, 139 N Clark St, Chicago, Ill.

Stoker Manufacturers Assn, 32nd annual meeting, French Lick, Ind., June 13-14, 1949. Papers identified by initials SMA. Available through Marc G Bluth, sec, SMA, 307 N Michigan Ave, Chicago, Ill.

Because large quantities of energy are stored in furnishings and building materials, the cooling load at a given time is seldom the same as the instantaneous total rate of energy emission from the various sources. Therefore, heat gains are not cooling loads.

Information on cooling loads available to engineers consists almost entirely of the total rates of emission of energy by various sources. There are so many variables that influence the true cooling load in addition to these energy release rates that determination of true cooling load does not lend itself to an exact analytical approach.

This paper gives specific examples of the relations between cooling loads and instantaneous rates of energy emission. Examples include: solar roof load in a one-story building; solar roof load in a multi-story building with various roof and floor constructions; cooling load from human occupants. From these examples tentative general conclusions are drawn concerning the relation between cooling loads and rates of energy emission. *ASHVE paper. No number.*

SMOKE ABATEMENT

SMOKE AND FUMES ABATEMENT IN THE OIL INDUSTRY, *by Homer Reed, Union Oil Co of California.* To appraise the activities of the oil industry intelligently in the smog situation in Los Angeles County requires knowing what makes smog: (1) what substances must be present in the atmosphere and (2) how these contaminants affect the atmosphere.

But the component parts of smog are still indefinable. The conditions of smog are well-known to the layman. Visibility is lowered and the eyes are irritated. One contributing factor is the tremendous growth in the Los Angeles area—population in 1940, 2,685,000, and in 1949 up to 3,881,000, as well as 3800 new industrial plants.

The oil industry shared in this growth and the quantity of its production increased. The only contaminants refineries release to the atmosphere are sulphur dioxide and trioxide. The average amounts released ran from 200 to 260 tons of sulphur dioxide per day from 1929 through 1943. Since then the amount increased to about 440 tons per day in 1947. Yet in no case is the concentration higher than 0.2% of sulphur dioxide in the stack gases. Further, the tonnage of sulphur dioxide put out by refineries in Los Angeles area represents only about half the total; the balance comes from others burning sulphur-containing fuels.

Over and above the sums of money the oil industry is spending to reduce the tonnage of sulphur dioxide leaving the refineries is a program they have established at Stamford Research Institute to study smog. From the SRI studies it is hoped that the properties of smog—its constituents, nature, effect of weather, etc—will be determined and thus its solution be furthered. *SPA Paper. No number.*

SOLID FUEL INDUSTRY'S CONTRIBUTION TO AIR-POLLUTION PREVENTION, *by W S Major, Bituminous Coal Research.* Solid fuel, and more specifically, bituminous coal, will continue to be the basic source of energy for industrial production and heating of homes. The Federal Power Commission reported in 1947 nearly 70% of electricity produced in the U.S. was from coal, oil, gas, wood and wastes. Of this 78% was from coal.

In the railroad field in 1946, coal provided about 71% of the Class I line-haul locomotive-fuel requirements.

The coal industry recognizes its civic responsibility in smoke abatement. It has a well-organized program to meet this responsibility: (1) research in improved use of bituminous (2) field activities to promote improved performance of existing equipment and encourage commercial production of the industry's research developments.

Research is handled largely by the nonprofit Bituminous Coal Research, Inc, and the Locomotive Development Committee. Field activities are being carried out by groups such as the Coal Producers Committee for Smoke Abatement and similar organizations in Indiana, Illinois and other states. These field activities include full or partial

(Continued on page 166)

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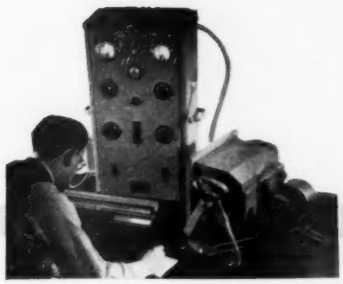

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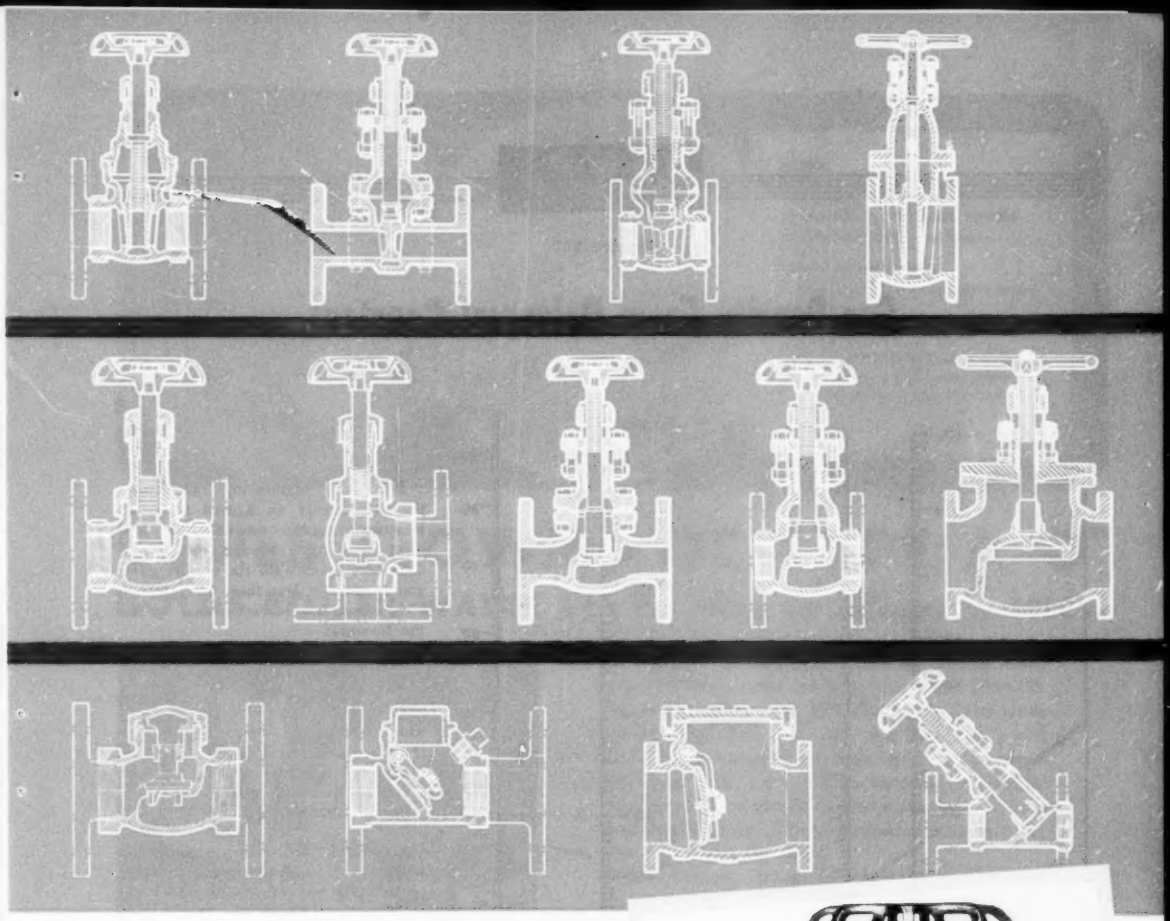

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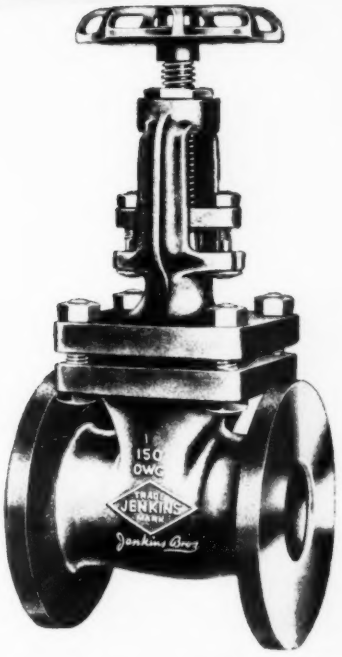
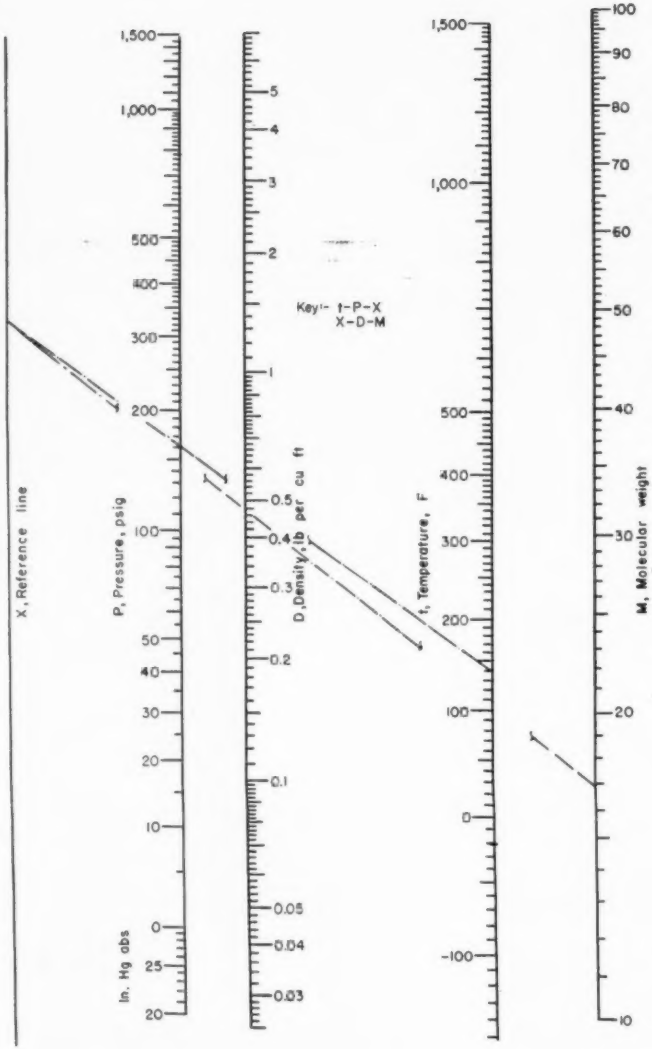


POWER'S DATA SHEETS

Number 207

Gas Density From Universal Constant



For most engineering calculations the gas density as figured from the formula using the universal gas constant is accurate enough. The maximum error occurs for the heavier gases and is usually less than one percent. This nomogram makes it easy to use the formula:

$$D = \frac{M(p+14.7)}{10.72(t+460)}$$

where
D = gas density, lb per cu ft
M = gas molecular weight
p = gas pressure, psig
t = gas temperature, F

Example: A gas with a molecular weight of 17 and exerting a pressure of 162 psig has a temperature of 140 F. What is its density?

Lay a straight edge across the temperature and pressure scales at the given values to intersect the X or reference line. From here lay a straight edge to intersect the molecular-weight scale and read the answer on the density scale: 0.47 lb per cu ft.

By John F Hyam
Sarnia, Ont, Canada

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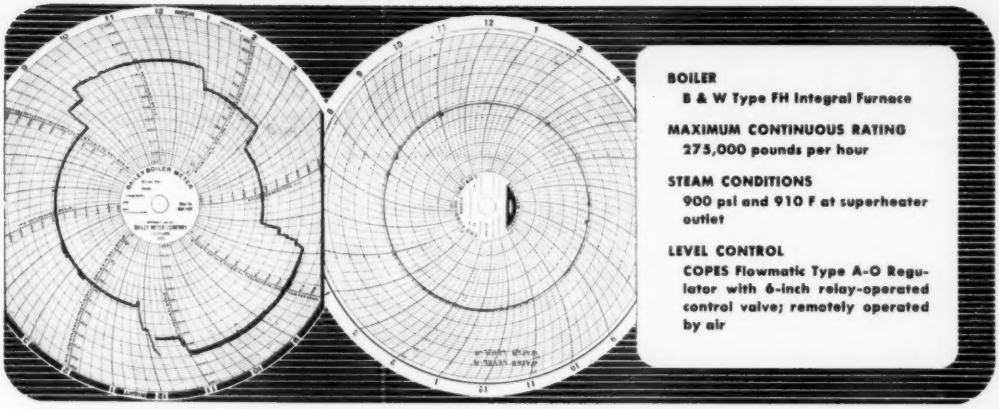

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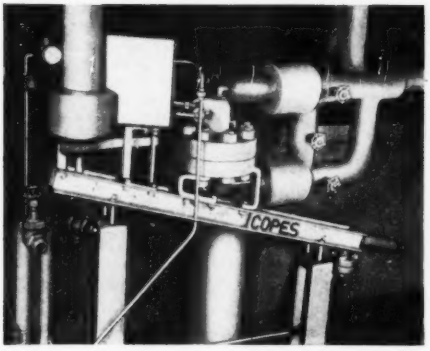
MAXIMUM CONTINUOUS RATING
275,000 pounds per hour

STEAM CONDITIONS
900 psi and 910 F at superheater outlet

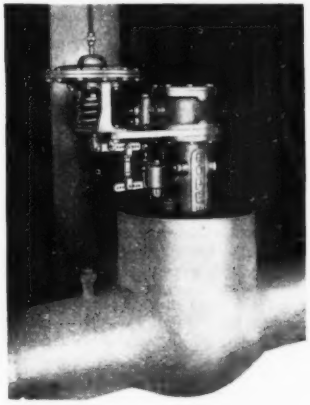
LEVEL CONTROL
COPES Flowmatic Type A-O Regulator with 6-inch relay-operated control valve; remotely operated by air

COPES FLOWMATIC TYPE A-O*

HOLDS BOILER WATER LEVEL *Plus or Minus* ½ INCH



* A-O means remote air operation, with both flow- and level-responsive elements (above) at any location with respect to the feed control valve (below). Fits any piping layout, any operating preference. Remote panel adjustment, if desired.



Maximum load recorded on the steam-flow chart was 250,000 pounds per hour; minimum, 135,000. There was a drop from 235,000 to 132,000 pounds per hour between 11:50 p.m. and 12:10 a.m., with a total level change of less than one inch. Between 8:00 and 8:08 a.m., a load increase of 50,000 pounds per hour resulted in no more than 1.2 inch total level change. During periods of constant load, water level was constant.

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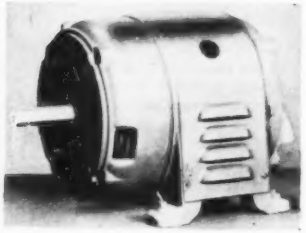
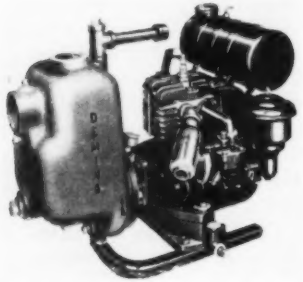


P953 • DIRECT - MOUNTED MOTORS—*Unimount* motors are equipped with machined brackets to mount direct on almost any driven machine. They are suitable for pumps, compressors, mixers, machine tools, blowers, woodworking machines, grinders, etc.,

In many cases belts, chains, guards, right angle gears, or cumbersome power transmission devices can be eliminated. Resulting "built-in" appearance lends eye-appeal to driven machines as well as providing additional safety for operator by elimination of external drive appurtenances. Ratings are from ½ to 500 hp.

U.S. Electrical Motors, Inc, Los Angeles 54, Calif., and Milford, Conn.



P940 • PORTABLE PUMP—Designed for a wide variety of drainage or water-handling jobs where electric power or belting drive is not available, self-priming centrifugal pump has a 1½-hp, 4-cycle, air-cooled gasoline engine. Pump has cast-iron casing, bronze impeller mounted directly on engine shaft, and a mechanical shaft seal eliminating need for stuffing box and packing gland.

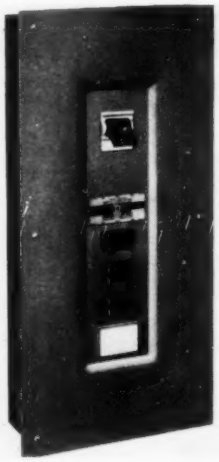
Pipe connections are 1½ in. suction and 1½ in. discharge. Dimensions are: length 20 in., width 13 in., height 19 in., weight 83 lb. Ratings range from 10 gpm with 80-ft head to 90 gpm at 15-ft head.

Deming Co, Salem, Ohio.

P958 • SELENIUM RECTIFIER — *Powerector* delivers 10-50 times more dc than conventional stack rating. It is available in ac rms blocking voltage up to 40 v per cell.

Rectifier withstands large overloads for short time periods or duty cycles. Unit is suitable for all heavy power applications.

Standard Arcturus Corp, 54 Clark St, Newark, N.J.



P956 • CIRCUIT BREAKER PANEL—A 12 to 20 circuit Panelette with "plug-in" circuit breaker units for either 3 or 4 wire service is approved for "service entrance" applications where circuit breaker in mains is required. Unit incorporates thermal-magnetic circuit breaker units that plug-in on cylindrical bus bars.

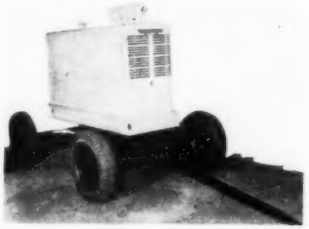
Boxes are 12 in. wide and 4 in. deep, permitting surface or flush installation in shallow walls with studs on 16 in. centers. National Electrical Code requires a main disconnect where more than six handles are involved.

Square D Co, 6060 Rivard St, Detroit 11, Mich.

P915 • CONVECTOR—Wall-type, low-height, high-heating capacity convector. 13.9 to 53.2 EDR with 1 lb of steam and 65 F inlet air, 10⅜ in. high by 5½ in. wide, is made in lengths from 2 ft to 6 ft in 6 in. increments. Design may be used on steam or forced circulated water with working pressures up to 150 psi.

A series of these units may be installed to form a continuous convector with a sheet metal splice plate to conceal pipe connections between each unit. Cabinet has a removable front with a horizontally slotted outlet grille. There are three choices of pipe heating elements: (1) steel pipe with steel fins (2) steel pipe with aluminum fins (3) copper pipe with aluminum fins.

C A Dunham Co, 400 W Madison St, Chicago 6, Ill.



P971 • TRAILER DIESEL SETS — Fully equipped and self-contained trailer-mounted diesel-electric sets range in capacity from 10 to 85 kw, are designed for on-the-job operation in oil fields, construction work, etc. They are available for all standard voltages, 50 or 60 cycles.

Sets consist of an engine driving a generator, with an instrument panel containing all starting controls and switchgear, spring-mounted on a pneumatic-tired 4-wheel trailer having a steel-angle drawbar. Sets are also available with gasoline-engine drive.

International Diesel Electric Co, 13-02 44th Ave, Long Island City 1, N.Y.

P919 • VALVE OPERATOR—Simplified fluid motor operator for gate valves can easily be adapted to standard valves in stock or to those already installed. The device may be operated by water, oil or compressed air or gas at 40 to 300 psi.

Motor unit, comprising motor, gear box and yoke, is bolted to valve bonnet and motor operates valve through gear box. Motor gets its power from five flexible diaphragms, mounted radially about an eccentric on drive shaft. Operating fluid is admitted in rotational sequence to the five diaphragms, which actuate pistons that

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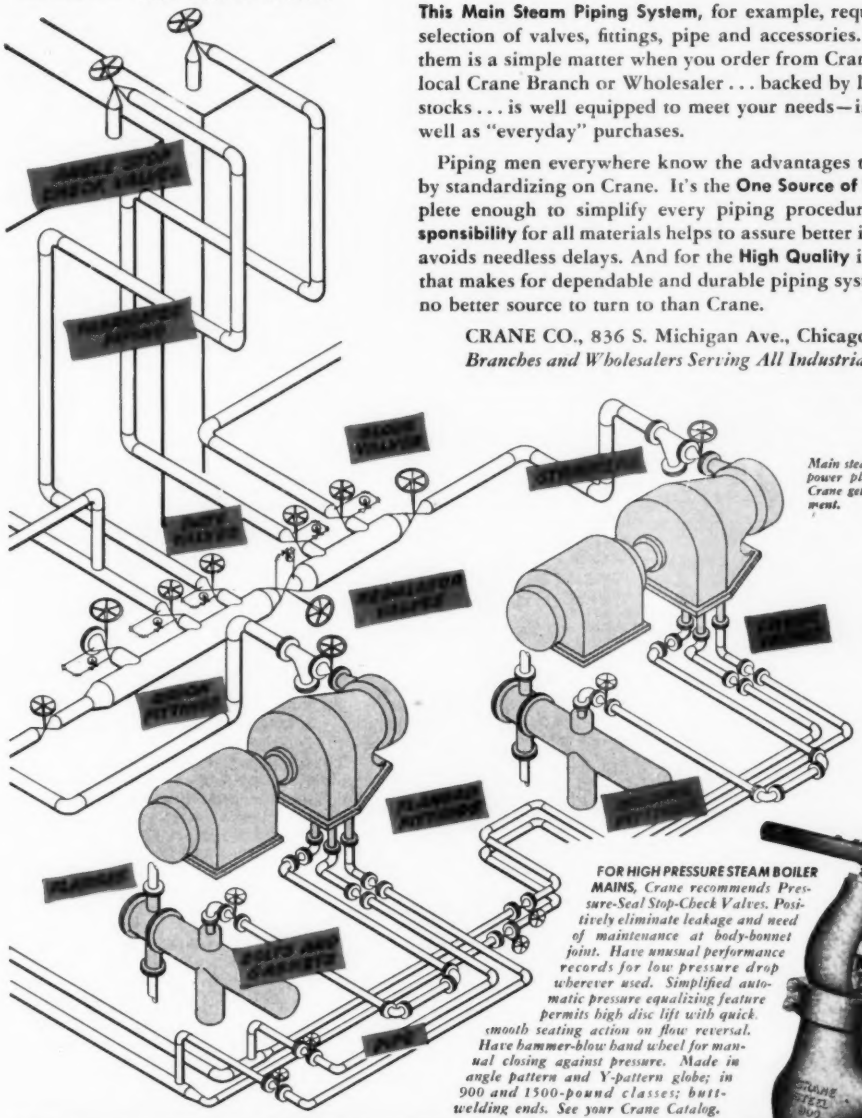

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When valve gate reaches end of its travel in either direction, motor merely stalls. There is no leakage and shutoff devices are unnecessary.

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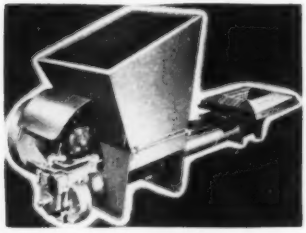
Warren Steam Pump Co, Warren, Mass.



P914 • UNDERFEED STOKER—Worm-Feed, special lubrication warning cup features Type *F* underfeed stoker, available in seven capacities with three styles of retorts, manual or automatic air-control.

The special oil-level cup connects by a channel to bottom of gear case of stoker-drive. If water accumulates from condensation or other causes in the case it forces a slug of oil out of cup. This overflow warns operator of water in gear case and drain-plug can be opened. Type *F* comes in seven sizes with coal-burning rates from 75 to 312 lb per hr. Sheaves on motor and drive shafts provide three speeds of coal feed.

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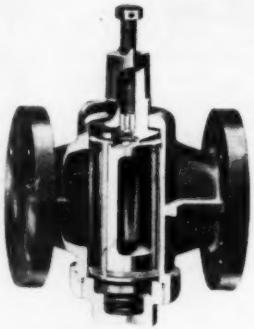
P943 • LEAD-COVERED CABLE—An anti-corrosion jacket is applied to lead-covered power cables. The corrosion-protective covering is a taped, vulcanized neoprene hose jacket.

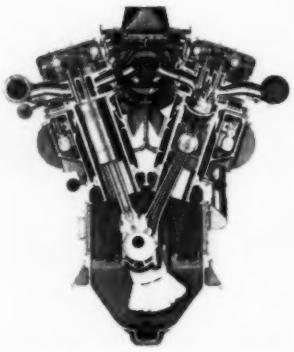
The lead sheath is coated with an adhesive, and three glass-fabric tapes impregnated and coated with a substantial thickness of neoprene are then applied spirally. This is followed by a wrap of cotton-reinforced neoprene tape, with a 10% overlap. The jacket is then vulcanized, after which a smooth wax finish is applied over the completed jacket. The total completed thickness of the jacket is nominally 0.079 in. The protective covering allows a reduction in lead-sheath thickness that results in a cable that is lighter in weight and smaller in diameter.

General Electric Co, Bridgeport 2, Conn.



P920 • PLUG VALVES—*Homestead-Reiser* self-sealed plug valves have a wedge action that not only adjusts itself for wear but also keeps sealing surfaces of plug and body in intimate contact to provide tight seal and lower lubricant losses. Port areas are equal to the area of standard pipe. Other features are complete lubricant seal around the ports and positive visible stops to limit operation to a quarter turn.

Homestead Valve Mfg Co, Coraopolis, Pa.



P973 • LARGE "V" DIESEL—*LSV* engines, capable of operating as conventional oil-burning diesels or gas diesels, are offered in 12- and 16-cylinder models, supercharged and unsupercharged, covering an output range from 1300 to 3300 hp. Two banks of cylinders, 15½x22 in., drive a single crankshaft by means of articulated connecting rods. Developed from the in-line type *LS* diesels, the new units feature unusually low bearing pressures, motor-driven pumps, dual superchargers, exceptionally low headroom, larger 13½-in. diameter crankshaft.

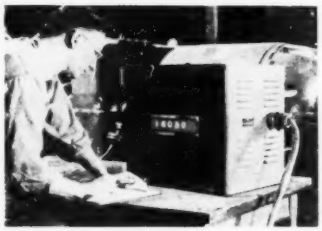
The 16-cylinder design, developing 3300 hp at 327 rpm, supercharged, requires only 275 sq ft of floor space. This represents 12 hp per sq ft. Dual-fuel operation permits most economical use of oil and gas fuels as determined by fuel price and availability. Refinement of the dual-fuel principle insures high thermal efficiencies even at partial loads. Input of gas and fuel oil is regulated automatically by engine controls to suit prevailing conditions.

Cooper-Bessemer Corp, Mt. Vernon, Ohio.

P924 • PIPE GUIDES—*Guide-Anchor-Guide* takes up increased length of pipe, occasioned by temperature changes in gas or liquid conveyed by piping system. Designed for anchoring expansion joints in pipe lines, the device can easily be fastened down.

Anchor and guide connections are prefabricated to fit and are welded to pipe in field. Unit may be modified to accommodate angular changes in pipe.

Piping Specialties, Inc, 114 Liberty St, New York 6, N. Y.



P964 • HIGH-SPEED TACHOMETER—Designed for accurate measurement of high speeds over a wide range, this new tachometer has a high-frequency pulse generator, an electronic counting circuit and two speed-indicating units. It is now being used for testing steam turbine efficiency.

Electronic counting circuit is housed in a 200-lb cabinet measuring about 5x2x1½ ft. Speed indicator located in a separate cabinet, about 2x2x1½ ft. Electromagnetic tachometer generator weighs about 5 lb and is about 6x8x4 in.

General Electric Co, Schenectady 5, N.Y.

P968 • HIGH TEMPERATURE RESIN—Ion exchange resin withstands the high-temperature effluent from hot lime-soda units and does final softening.

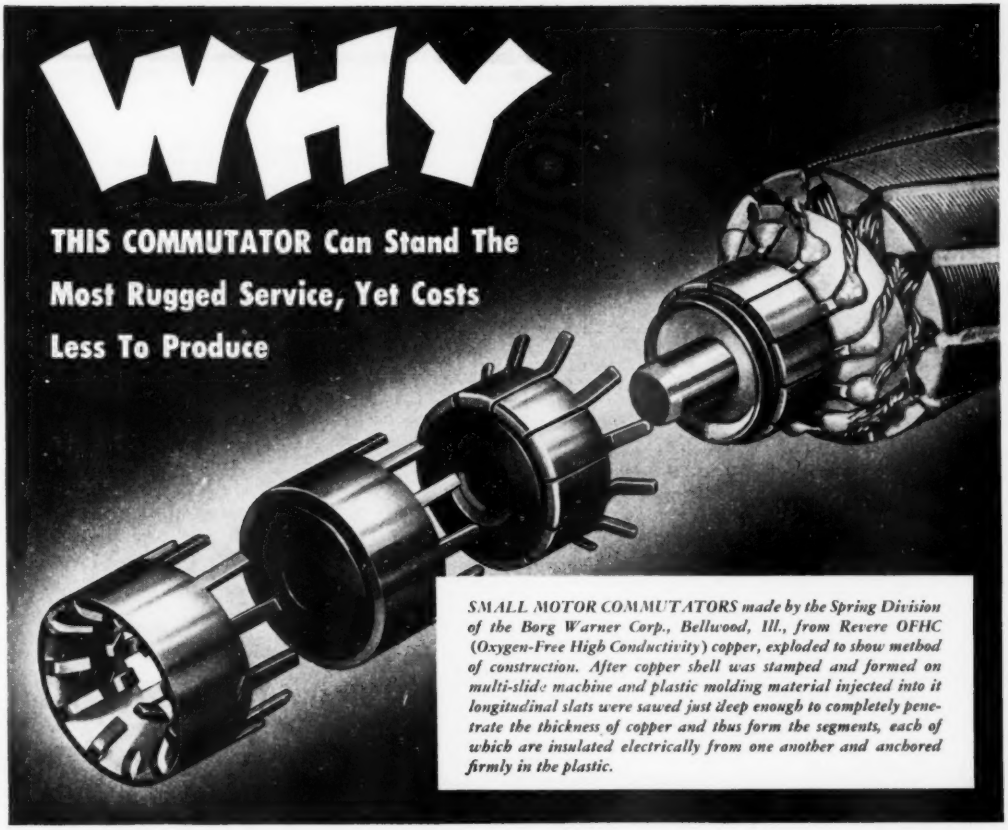
It also withstands both high and low pH conditions and can be given an acid wash to remove lime accumulations. This resin permits carrying lower excesses of lime and soda ash which lightens the filter load and gives less after precipitation.

Manufacturer says base exchange softener consistently shows zero hardness with no danger of scale deposit, in lines, pumps,

For further data on above items use reply cards on page 198a, identifying your request with letter *P* and number

WHY

THIS COMMUTATOR Can Stand The Most Rugged Service, Yet Costs Less To Produce



SMALL MOTOR COMMUTATORS made by the Spring Division of the Borg Warner Corp., Bellwood, Ill., from Revere OFHC (Oxygen-Free High Conductivity) copper, exploded to show method of construction. After copper shell was stamped and formed on multi-slide machine and plastic molding material injected into it longitudinal slats were sawed just deep enough to completely penetrate the thickness of copper and thus form the segments, each of which are insulated electrically from one another and anchored firmly in the plastic.

IT was quite a complex problem the Spring Division of Borg Warner Corp. dropped into the lap of Revere's Technical Advisory Service. They were getting set to manufacture commutators for small motors and they wanted to select the best material for the job.

Here were the specifications: The material had to be the hardest possible yet still able to take the extremely severe forming operation which was to be done in a multi-slide machine. High hardness was necessary in order to combine maximum wear resistance with the ability to withstand the extreme centrifugal force developed in small motors operating at high speeds. In addition, in the molding operation, which is done after the copper shells have been formed, it was necessary to hold the diameter of the shell to within .001" in order to prevent the plastic from flowing between the mold and the outer surfaces of the commutator. An equal tolerance was also imposed upon the height of the solid cylindrical portion for the same reason. Also of great importance was the need for the cylinder wall being almost absolutely flat.

Because of long experience with somewhat similar problems Revere recommended trial of OFHC (Oxygen-Free High Conductivity) copper, four numbers hard. This was tested along with several other metals. The OFHC alone was found to produce excellent parts, and with tolerances so close as to be almost unbelievable in this type of operation. All other types of copper failed at the very sharp bend where the anchoring lugs join the side of the shell.

An unusual feature of these commutators is the plastic material used in the core. Tough, and unusual in composition, it serves both as insulation and as a mechanical connection between commutator and shaft without use of a bushing and key.

To determine if these commutators could *really* take it, test motors in which they were used were speeded up to 35,000 rpm. Although the wiring in the rotors practically exploded at that speed, there were no failures in the commutators, Temperature tests up to 400° F. were also made. Here again there was no damage to the commutator, though the rotor wiring was badly damaged due to the combination of centrifugal force and decrease in wire strength. Once again the unusual combination of properties of Revere OFHC copper had played a part in helping another one of the country's leading manufacturers produce an outstanding product at less cost.

Perhaps this or some other Revere Metal can be of help in improving your product—cutting your production costs. Toward that end we suggest that you get in touch with your nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

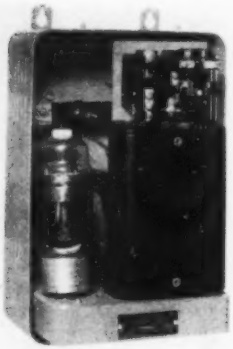
230 Park Avenue, New York 17, New York

• • •

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

preheaters or boilers. As a high-temperature base-exchange softener for after treatment of effluent from hot-process lime-soda, the unit removes last traces of hardness from boiler feedwater.

Illinois Water Treatment Co, Rockford, Ill.



P937 • ELECTRONIC MOTOR CONTROL—A new low-cost electronic dc motor adjustable-speed control, in ratings through ½ hp, utilizes a simplified half-wave circuit to provide dc from ac power. By the turn of a knob at a single control station, smooth stepless speed control is obtained on small lathes, grinders, drill presses, conveyors, pumps, packaging equipment, and paint and varnish mixers.

The drive operates from 220-v and has a 20-to-1 speed range from 1725 to 86 rpm and operates in ambient temperatures from 50 to 104 F. It is furnished in either the non-reversing or the reversing type, the latter being equipped with a separate magnetic reversing switch. Designed for constant-torque loads, under normal conditions the new drive has good speed regulation from no load to full load. The speed may be preset, or may be varied during operation and under load. Dynamic braking permits quick stopping.

General Electric Co, Schenectady 5, N. Y.

P969 • MOBILE POWER UNIT—Trailer-mounted 100-kw diesel-electric power unit can be towed along highways at 30-40 mph, used as peak-load source, emergency supply at hospitals, etc, cut off by storm or other power failure, and for temporary power and light at construction projects, fair grounds, etc.

Waukesha *WAKDU* 6-cyl 180-hp 1200-rpm diesel drives 125-kva 100-kw revolving field generator with V-belted exciter. Unit can supply 120/208, 240 or 480 v, 60 cycles, 3-phase, 3- or 4-wire, as desired. It can be operated at 1000 rpm for 85-kw output, 230/400 v, 50 cycles.

Fruehauf trailer has eight 7½x20 ten-ply tires, 16-ton carrying capacity and can be equipped with vacuum or air brakes. Equipment includes radiator and belt-driven fan, air filter, Maxim silencer, fuel- and lube-oil filters, switchboard containing voltmeter, ammeter, circuit breaker, indicating wattmeter, automatic voltage regulator and exciter field rheostat. Automatic safety shutdowns operate on low oil pressure and high water temperature. Gasoline-engine starting is standard but electric starting can be substituted at no extra cost. A 200-gal fuel tank is mounted under the chassis; this permits operation for about 24 hr without refueling.

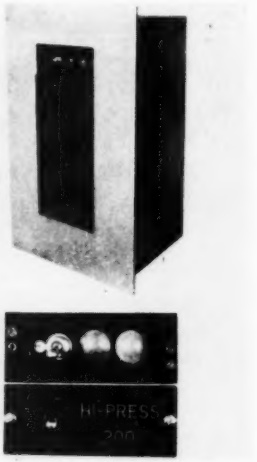
Design provides ample clearance inside body; watertight construction; locked steel screens for door openings; space on forward trailer platform for transformer; space for lightning arresters and indoor disconnecting switch. Unit can be arranged for automatic start and stop, controlled by power failure or predetermined timing. Oil-reclaiming equipment, air compressor and floodlighting equipment are optional.

Sinex Projects, Inc, 40 Wall St, New York 5, N.Y.

P949 • GAGE LIGHT—Device allows liquid level to be read easily at greater distance. Light from single light source is reflected from an angular surface and flows with evenly diffused intensity through transparent gage glass. Illuminators are made in both explosionproof and standard models for all sizes of transparent gages.

They are also made in both single and double section styles. Standard small bulb is used for light source.

Jerguson Gage & Valve Co, 80 Fellsway, Somerville 45, Mass.



P960 • LAMP ANNUNCIATOR—Unit is for central supervision of all factors equipped with electrical contacts, (normally open or normally closed) such as temperature, pressure, etc. Each section or "drop" is 3¾ in. wide and 1½ in. high, with two square in. (2 in. wide x 1 in. high) for illuminated designation engraving.

In a typical case when the contact is made, the audible signal sounds trouble and the engraved message is lighted in white and red. Flipping the toggle switch eliminates the audible signal and then message is lighted in all-white. When contacts return to normal, an audible signal sounds till the operator throws toggle switch.

H R Kirkland Co, Morristown, N.J.

P928 • GOVERNOR CONTROL—*Wallene* governing control regulates load settings of turbine or engine driven generating units that are operating in parallel with a second source of power so that ratio of service from the two sources is automatically maintained at most economical level.

Device can be adjusted to proportion the load so that: (1) Maximum demands on the source economically desirable to favor do not exceed a predetermined top level. (2) A fixed minimum prevents return flow of power to the favored source when demands for process heat may be high and electric power low. (3) Although the minimum is a fixed setting, the maximum setting is automatically lowered from its top fixed limit to lower levels and back again

For further data on above items use reply cards on page 198a, identifying your request with letter P and number

DUQUESNE LIGHT COMPANY'S Frank R. Phillips Power Station at Wireton, Pa. Units 2 and 3, now being constructed by Dravo, will more than triple the original 75,000 kw capacity of this key station serving the Pittsburgh area.

DRAVO
CORPORATION
DRAVO BUILDING, PITTSBURGH 22, PA.

Engineering Constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations—fabricators and erectors of power piping—power and boiler plant equipment.

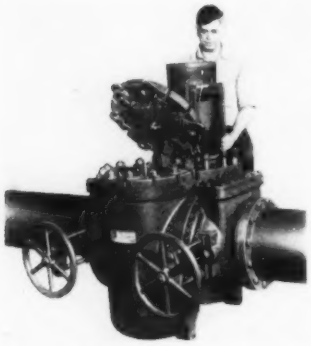
PITTSBURGH • PHILADELPHIA • CLEVELAND • NEW YORK • DETROIT

EQUIPMENT NEWS CONTINUED

as variations occur in plant demands for process steam. This is accomplished by a pressure response element that varies torque of electrical measuring element.
Meriam Instrument Co, 10920 Madison Ave, Cleveland 2, Ohio.

P942 • ROTARY PUMPS—A mechanical seal and a self-lubricating inboard sleeve bearing to carry overhung drives feature this line of rotary pumps. The seal is subject to suction pressure only and remains tight even at high vacuum.

Suited to high-vacuum applications, these pumps are designed for handling liquids comparatively free from abrasive or corrosive substances but can handle considerable amounts of air or gas in the liquid. They are used for handling liquids of various viscosities from tar, molasses, heavy oils to light liquids such as gasoline and kerosene.
Worthington Pump & Machinery Corp, Harrison, N.J.



P974 • STRAINERS—New line of twin strainers are built in sizes up to 24 in. for removing foreign matter from water, oil and other liquids at pressures up to 125 and 250 psi.

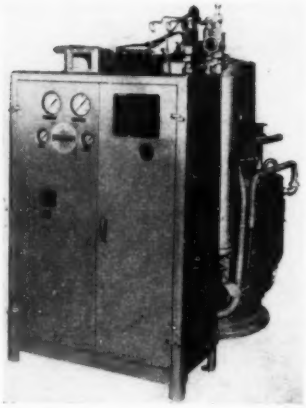
Either chamber can be shut off for removing and cleaning strainer basket, without interrupting flow. There are no moving parts, except valve mechanism. Low-pressure drop is claimed. Strainers have cast Meehanite bodies with steel plate doors. Baskets are of hard copper mesh on rigid frame.
Elliott Co, Jeannette, Pa.

P911 • STEAM GENERATOR — New design atomizing burner nozzle that permits a changeover from oil to gas without changing the nozzle highlights new steam generator line.

New models, available in sizes from 350 to 10,500 lb per hr steaming capacity and in pressures from 15 to 200 psi, include a simplified air supply system, improved combustion and ignition programming controls and a blower-air channel design for quiet operation.
Dept 18-R, Cyclotherm Corp, 90 Broad St, New York 4, N.Y.

P975 • INSULATION TESTER — Hand-operated instrument has a testing range from 0 to 100 megohms. Electronic control assures uniform 500-v test voltage over a wide range of cranking speed.

Red indicator light tells when correct testing voltage is being delivered. Tester weighs 3 lb and measures 3¾x6x3¼ in.
Holtzer-Cabot, Inc. 125 Amory St, Boston 19, Mass.

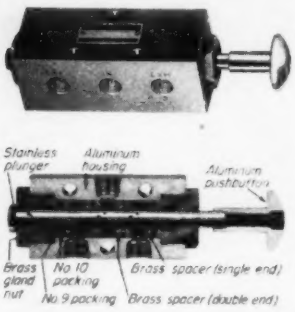


P976 • STEAM BOILER — Quick starting—up to 200-psi pressure from a cold start in two minutes—diesel-oil burning steam generator, Model *OK*-4625, releases 1,000,000 Btu's per cu ft to generate 2500 lb per hr of steam in 500 ft of seamless-steel tube coils.

One electric motor, drawing 2 amp per 100 lb of steam, operates fuel and water pumps, blower and ignition systems. Boiler cycles on and off to maintain any desired pressure between 75 and 250 psi. Over-all size is 40x68x73 in. It is built to ASME code specifications.
Vapor Heating Corp, 4501 W 16 St, Chicago, Ill.

P966 • FLUORESCENT LAMP — A new fluorescent lamp remains bright up to 5000 burning hr with an average life of two years. Formerly, discoloration and a drop in efficiency could be expected after 1750 hr of burning.

Longer life represents gain over 200% in lighting value per lamp dollar. Increased efficiency is accomplished by preventing glass bulb impurities from reacting with phosphor coating.
Sylvania Electric Products, Salem, Mass.

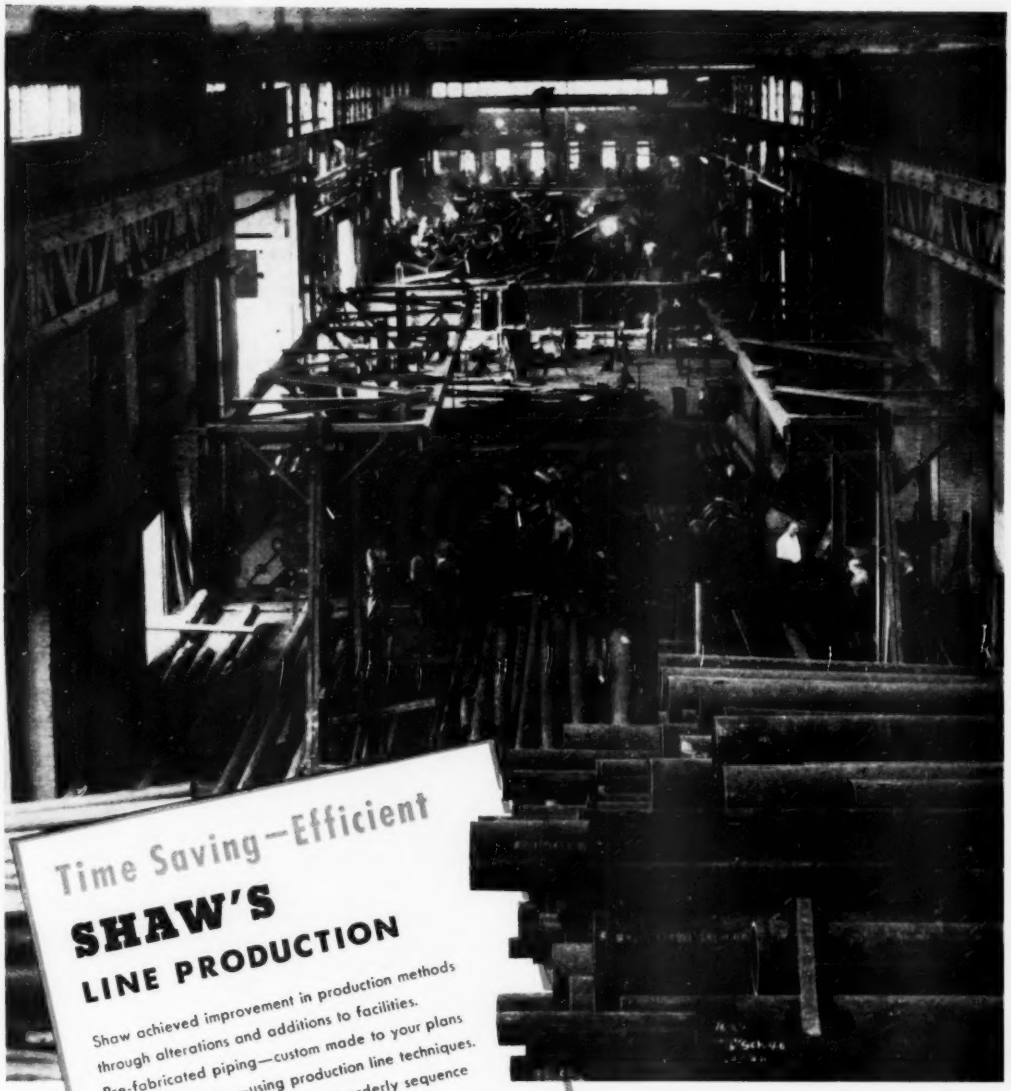


P977 • CONTROL VALVE—Radically new design of *Quick-as-a-Wink* valve requires small operating force and holds any position. Valve has hollow stainless-steel plunger with precision-placed ports moving in aluminum housing, lined with carefully positioned brass spacers. Valve can be completely disassembled for repacking and reassembled in a few minutes, without disturbing the connecting plug.

Series *O* and *OE* valves are furnished tapped for either ⅛- or ¼-in. pipe connections. They are available in 2-way, 3-way open exhaust, 3-way piped exhaust and other arrangements. Valves are suitable for service with air, oil or water at pressures up to 125 psi maximum.
C B Hunt & Co, Salem, Ohio.

P978 • DIESEL PYROMETER — *Alnor* 1160 pyrometer, a continuously operated monitoring instrument, automatically measures cylinder exhaust temperatures of diesels. Designed to reduce personal attention, device can be equipped with an excess-temperature cutout which actuates

For further data on above items use reply cards on page 198a, identifying your request with letter P and number



Time Saving—Efficient

SHAW'S
LINE PRODUCTION

Shaw achieved improvement in production methods through alterations and additions to facilities. Pre-fabricated piping—custom made to your plans and specifications—using production line techniques. All fabricating operations are in orderly sequence —no backtracking—a definite saving in time. This improvement in facilities is another forward step in Shaw's progressive program of expansion.

BENJAMIN F. SHAW COMPANY
2nd & Lombard Sts. Wilmington, Delaware

Interior of Pipe Storage & Cutting Departments —showing partial view of line production set-up.

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping throughout the world.

President

KNOWN SINCE 1893 FOR HIGH-QUALITY PIPING PRE-FABRICATION AND INSTALLATION

EQUIPMENT NEWS CONTINUED

alarm systems or engine-shutdown controls if exhaust temperature of any cylinder goes too high.

Large clock-like dial indicates switch positions and can be read from 20 ft. Pyrometer is *Alnor R*-type movement with new, more legible scale. Switch has motor-driven rotary arm actuating leaf contact assemblies. Overlaps keep pointer from returning to zero between positions. Any large deviation from a general average immediately shows on pyrometer scale. Push-button on front panel enables operator to stop rotating switch on any selected position for longer readings.

Illinois Testing Laboratories, Inc, 420 N LaSalle St, Chicago 10, Ill.

P979 • CARBIDE ROTATING CUTTERS—Expanded line includes 40 shapes in rotating carbide cutters for filing, burring, grinding, finishing, profiling, etc.

It is described in carbide rotary cutter Bulletin C-549.

M A Ford Mfg Co, Davenport, Iowa.

P980 • GAS BURNER—Self-contained gas burner, Series 115, for boiler service, is a package unit that is available in two sizes. The 115-2.5 for 2,500,000 Btu input and the 115-5 for 5,000,000 Btu input generate about 1800 lb per hr and 3600 lb per hr of steam, respectively.

All combustion air enters through the burner under control of an integral blower. This enables a close fuel-to-air ratio control. It is furnished complete with a control panel with all safety devices, and a modulating control for fully automatic operation.

North American Mfg Co, 4455 E 71st St, Cleveland 5, Ohio.

P981 • SEWAGE-DISPOSAL PROCESS—Nepeco process filters out solids near point of origin and consumes them in oil-fired portable incinerator.

Cone filter has rotary brush. Mobile incinerator uses diesel oil. System is said to relieve institutions and communities of great expense and difficult disposal problems.

Nepeco, Inc, 899 Boylston St, Boston 16, Mass.

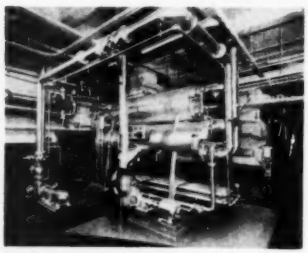
P982 • MULTIPLE FLOWMETER—New Multi-tube rotameter has two or more visible rotor-type flowmeter tubes in same casing for easy comparison of related load.

Standard Brooks full-view rotameter is mounted in case. Advantages claimed: compactness, close correlation of related load, less cost than individual meters.

Brooks Rotameter Co, Lansdale, Pa.

P963 • STORAGE BATTERY—*Z* plate line is designed for diesel-starting, railroad air conditioning and car lighting. New casting rates and mold-temperature control techniques reduce battery's positive grid porosity from 85 to 90%, thus reducing vulnerability to sulphuric acid attack, resulting in longer life and better electrical characteristics.

Gould Storage Battery Co, Trenton, N.J.



P983 • ABSORPTION MACHINE—New refrigerating machine employs either high- or low-pressure steam in a generator tank to boil off water vapor absorbed in a refrigerant absorber.

Here is how the high temperatures absorption refrigerating machine works: Water to be chilled is sprayed into flash evaporator in upper portion of absorber-cooler shell. This shell, always under a high vacuum, evaporates a portion of the chilled water and cools remainder. Chilled water drains from cooler tank and is pumped to the load. Temperature of this chilled water leaving the machine depends on concentration and temperature of salt solution sprayed over coil in lower or absorber section of shell. Salt solution absorbs water vapor flashed in evaporator. Heat of absorption of this vapor raises temperature of solution that is cooled by passing water through the absorber coil.

Once this water is absorbed the refrigerant salt solution weakens. Therefore, it is drained from the tank and delivered to the upper shell for reconcentration. This reconcentration takes place in generator or steam coil section.

Carrier Corp, Syracuse, N. Y.

P913 • RESISTANCE WELDING CONTROL—Accessory slope control for synchronous or non-synchronous resistance welding machines provides a gradual welding current increase at beginning of a weld to reduce tip pickup in spot welding.

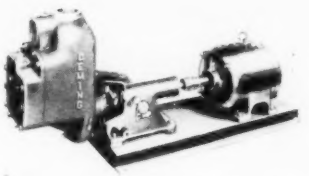
Laboratory tests resulted in 20 times as many spot welds on 0.064 in. 24 *ST Alclad* aluminum before sticking occurred as compared to no control. Control is furnished in two types: (1) mounting in side of synchronous controls (2) a separate enclosure for older controls and non-synchronous controls. Setting of one dial, graduated from 3 to 13 cycles in one-cycle steps, determines welding current time from low to final value. The other dial, graduated in percent of final current, permits adjustment of initial value of welding current.

Controls Div, General Electric Co, Schenectady 5, N.Y.

P984 • HOSE GRIP—Simple, inexpensive device, *Kool-Grip*, clamps around the hose near the nozzle end. Outside covering is molded rubber secured to a crimped, curved metal base.

The crimp holds the grip away from the hose. Adapters are provided to fit all standard sizes of commercial hose.

Duffy Industries, 536 S E 6th Ave, Portland 14, Ore.



P985 • SELF-PRIMING PUMPS—Six stationary models cover a range of capacities from 10 to 300 gpm against heads up to 250 ft and one portable type has a capacity range of 10 to 90 gpm against respective heads of 80 to 15 ft.

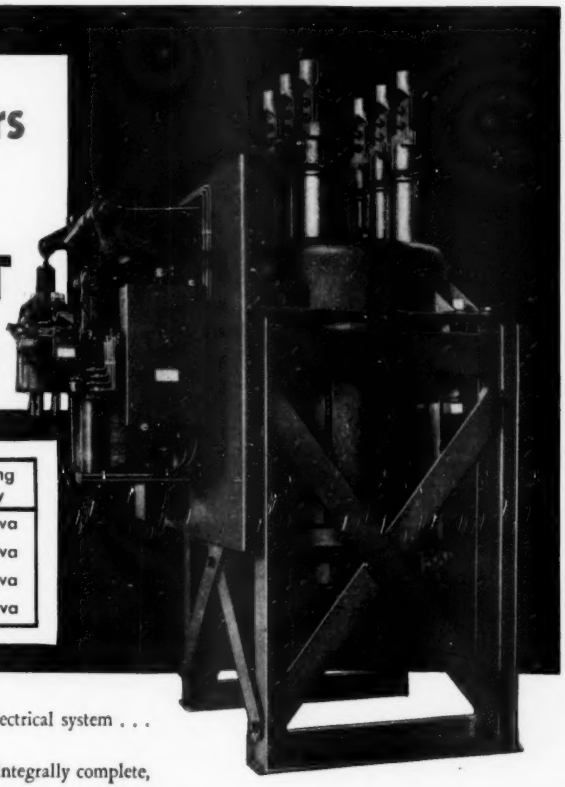
Uses of the stationary types include general industrial pumping services, mine gathering service, irrigation or dewatering service and sump or bilge pumping. The portable type is used for a wide variety of drainage or water-handling work. Priming is fast and automatic. A non-siphoning feature assures automatic repriming regardless of amount of backwash or suction line surge encountered when pump stops. Self-priming on suction lifts up to 25 ft.

(*Continued on page* 172)

For further data on above items use reply cards on page 198a, identifying your request with letter *P* and number

SAVE DOLLARS SPACE

with Allis-Chalmers Type DZ INDOOR OIL CIRCUIT BREAKERS



Type	Rated KV	Interrupting Capacity
DZ-40B	7.2	100,000 kva
DZ-60B	13.8	150,000 kva
DZ-100B	13.8	250,000 kva
DZ-200B	13.8	500,000 kva

HERE'S ECONOMICAL PROTECTION for your electrical system . . . with minimum space requirements.

"DZ" breakers are economical because they're integrally complete, with supporting framework, solenoid operator, control relay and auxiliaries — ready for installation. They can readily be used to replace existing breakers, in *existing cell structures*, where larger interrupting capacities are required.

They're space-saving, because they're compactly designed. Whether you're expanding or revising your present system . . . or installing a *new* system . . . remember that space requirements can be kept to a minimum with compact "DZ" protection.

Send coupon today for detailed information on Allis-Chalmers dollar-and-space-saving "DZ" oil circuit breakers. Or contact your nearby A-C sales representative.

GET DZ BREAKERS IN THESE MOUNTING ARRANGEMENTS

- ✓ Cell Mounted
- ✓ Frame Mounted
- ✓ Flat Surface Mounting
- ✓ Vertical Lift Metal Clad Switchgear

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

ALLIS-CHALMERS, 952A SO. 70 ST., MILWAUKEE, WIS.

Please send bulletins 7186129 and 7186179, giving specifications and dimensions of DZ Breakers.

Name

Title

Firm

Address

City State

A-2750

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

ASME Nominates Cunningham President

► JAMES D CUNNINGHAM, president of Republic Flow Meters Co, of Chicago, is the 1950 nominee for president of American Society of Mechnical Engineers. He heads a slate of new officers, including four regional vice-presidents and two directors-at-large, submitted by the nominating committee during the society's semiannual meeting at San Francisco, June 27-July 1. As the committee presents only one name for each office, nomination is tantamount to election.

Formal election will take place this fall by letter ballot of the membership, which totals more than 25,000 engineers throughout the United States. The new slate of officers will begin their terms at the end of the ASME annual meeting in New York next December. Cunningham will succeed James M Todd, consulting engineer of New Orleans.

Born in Chicago in 1887, Cunningham began his industrial career as a clerk for Armour Glue Works, after graduating from Hyde Park High School in 1905. He served as vice-president of Clyde Machine Works Co from 1909 until 1911 when he left to found and

(Continued on page 214)

Casing for 350,000-gpm Centrifugal Pump

This huge pump casing, cast in four parts at Farrel-Birmingham foundry, Ansonia, Conn., is made of high-strength Meehanite metal and weighs 121,050 lb. The smallest of the four sections weighs 21,900 lb and the heaviest 36,200 lb. The casing is one of five being supplied Worthington Pump and Machinery Corp for 84-in., vertical-shaft volute, 350,000-gpm, 180-rpm pumps for normal head of 197 ft. Each pump will be driven by a 22,500-hp motor. The five units, when installed in the Tracy pumping plant of U. S. Bureau of Reclamation Central Valley Project, Calif., will supply about 2500 mgd for irrigation. Impellers for the pumps, which are made of high-tensile bronze, are 145 in. in diameter and each weighs 36,000 lb

COMING EVENTS

Sept 12-16—Instrument Society of America, convention, Municipal Auditorium, St. Louis, Mo. Richard Rimbach, secretary, 1117 Wolfendale St, Pittsburgh 12, Pa.

Sept 28-29—American Society of Mechanical Engineers, fall meeting. Lawrence Hotel, Erie, Pa. Ernest Hartford, executive assistant secretary, 29 W 39th St, New York 18, N. Y.

Oct 3-4—National Assn of Corrosion Engineers, south central region meeting. Adolphus Hotel, Dallas, Texas. G R Olson, United Gas Pipe Line Co, Box 1407, Shreveport 92, La.

Oct 3-5 — National Lubricating Grease Institute, annual meeting, Hotel Roosevelt, New Orleans, La. Harry F Bennetts, NLGI, 4638 Mill Creek Parkway, Kansas City 2, Mo.

Oct 6-7—Prime Movers Committee, Pennsylvania Electric Assn, Hotel Edison, Sunbury, Pa. John W Mikels, chairman, c/o Pennsylvania Power Co, 19 E Washington St, New Castle, Pa.

Oct 16-21—American Welding Society, 1949 annual meeting, Hotel Cleveland, Cleveland, Ohio. M M Kelly, secretary, American Welding Society, 33 W 39th St, New York 18, N. Y.

Oct 17-19 — Engineers' Society of Western Pennsylvania, tenth annual water conference, Hotel William Penn, Pittsburgh, Pa. H M Olson, chairman, water conferences, ESWP, Hotel William Penn, Pittsburgh, Pa.

Oct 17-21—National Metal Congress and National Metal Exposition, Public Auditorium, Cleveland, Ohio. Walter Morrison, 7301 Euclid Ave, Cleveland 3, Ohio.

Oct 26-27 — Coal Div, American Institute of Mining and Metallurgical Engineers, and Fuels Div, American Society of Mechanical Engineers, twelfth joint meeting, French Lick Springs Hotel, French Lick, Ind. J S Bond, chairman, publicity committee, c/o Enos Coal Mining Co, 1405 Merchants Bank Bldg, Indianapolis 4, Ind.

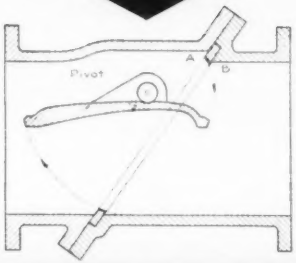
Nov 14-18 — Refrigeration Equipment Manufacturers Assn, 6th all-industry air conditioning and refrigeration exposition, Atlantic City Auditorium, Atlantic City, N. J. George E Mills, show director, 1346 Connecticut Ave, Northwest, Washington 6, D. C.

Nov 28-Dec 3—22nd Exposition of Chemical Industries, Grand Central Palace, New York 17, N. Y. Charles F Roth, International Exposition Co of New York, Grand Central Palace, New York 17, N. Y.

MAINTENANCE COSTS ARE LOWER

when you have *CUSHIONED CLOSING*

of—CHAPMAN CHECK (TILTING DISC) VALVES



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

That's right! Maintenance costs *are lower* with Chapman Check Valves . . lower because the balanced disc works *with the stream.* There's no slamming to cause destructive pipe line stresses and increase maintenance costs. Nor is there any rubbing on seats . . . the disc closes quickly and quietly with no sliding or wearing action.

Yet that's only half the story. Head losses are actually 65% to 80% lower than for conventional type check valves. And, when used on pump discharge lines, substantial power savings are possible.

Why not write today for engineering data and reports of tests.

THE CHAPMAN VALVE MFG. COMPANY
INDIAN ORCHARD, MASSACHUSETTS

Pencil Sharpening Can Be Overdone

Some of my friends tell me that this "shakedown period" we're in now is good for us. They cite the fact that prices in many lines have come down, that once again suppliers are courteous and giving service, that replacement parts can be obtained in the same week they're ordered.

I go along with this, and count on the plus side of my personal ledger the return to speaking terms with my butcher. However, there's one part of this "new look" in buying as applied to industrial products that isn't so good—that's the tendency to make *price* the sole consideration when ordering equipment and supplies.

Here we are again in times when budgets and appropriations are being fine-tooth-combed before approval. Operating expenses are being checked carefully for savings, and the heat's on to effect economies wherever possible. Naturally, that has made operating men doubly careful in their purchasing of equipment and supplies, and we're all shopping around for the best buy.

There's danger, though, in being a bargain-basement hunter, as a master mechanic in my neighborhood found out. He chucked his regular supplier, with whom he had been doing business for ten years, and bought some valves from a local machine shop (only cost half as much, and just as good as the ones he'd used previously). He's now back doing business with the old stand, after one of his new beauties opened up like a walnut, and another froze on him.

This isn't a plea for giving up careful buying and price comparison, because that's essential and basic to sound competition. But I do recommend strongly that you, and any contractors doing work for you, make sure *quality* isn't being sacrificed for bargain rates. Inferior equipment may last through the guarantee period, but it's pretty certain to give trouble before too long, and then comes the headache of tearing it out and replacing it.

Sharpen that pencil too fine, and somebody's sure to get stuck.

George Edwards

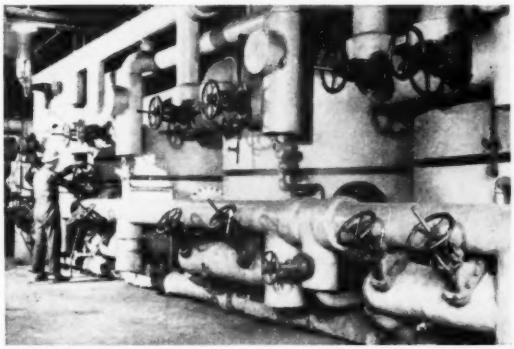
Engineer

DOWELL

SPECIALISTS IN SCALE AND SLUDGE REMOVAL WITH CHEMICALS

Filters cleaned in 7 hours

by Dowell Service



Quick, effective cleaning of industrial filters and filter beds now possible with Dowell Service

Three coal filters in a municipal power plant had been in use for three years. Although back washed weekly they were almost plugged with carbonate scale. *In less than seven hours,* Dowell Service restored the units to a high degree of efficiency. For most industrial filters and filter beds, as well as all types of heat exchange equipment, Dowell Service is the best answer for fast, economical cleaning.

Special solvents, selected to fit the particular scale problem, are pumped into the equipment utilizing existing connections. When the troublesome scale is dissolved or disintegrated, the spent solution is removed. The unit is then flushed out and put back into operation. No dismantling or modification of equipment is required—costly down time is minimized.

Dowell Service has been proved best in hundreds of cleaning operations. Skilled engineers, specialized equipment, and step by step control make Dowell the logical answer to your cleaning problem.

Call on Dowell for your next scale removal job. There is a Dowell office near you. Ask for a free cost estimate now.

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Baltimore 18	Chicago 2	New Orleans 12	Borger, Texas
Wilmington 99	St. Louis 8	Ft. Worth 2	Midland, Texas
Richmond 19	Indianapolis	Shreveport 23	Wichita Falls, Texas
Atlanta	Louisville	Anniston, Alabama	Lafayette, La.
Buffalo 2	Kansas City 8	Mt. Pleasant, Mich.	

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DOWELL

A SERVICE ORGANIZATION

POSITIVE SEAL...

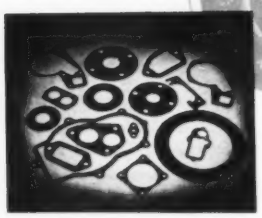
will not adhere to flange

After years of service, joints sealed with Russo 210 gaskets can be quickly and easily broken. Russo asbestos sheet packing has been thoroughly impregnated with heat resisting graphite. It will assure you pressure-tight joints that withstand time, heat and pressure. Russo is particularly recommended for superheated or saturated steam, compressed air, gas or ammonia and where the going is tough, and a rugged super duty sheet is required.

"LASTS AS LONG AS THE IRON"

That's our specification for style 210. You can have a booklet describing Russo and 110 other styles of outstanding CHESTERTON Mechanical Packings for the asking.

CHESTERTON Style 210
RUSSO SHEET PACKING



Intricate gaskets are easier to cut because of RUSSO 210's even texture. For gaskets that must *stand up*, keep sheets of easy working, super duty RUSSO 210 in stock.

RUSSO IS ONE OF 111 OUTSTANDING CHESTERTON STYLES

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A. W. CHESTERTON CO.

Established 1884

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ELECTRONICS

(Continued from page 128)

an ampere. This small current from cathode to grid causes such a small voltage drop across them that nearly all the 15-v bias appears across resistor R. This has the effect of connecting a 15-v battery in series to oppose the grid bias, in which case the grid has near zero potential.

Thus it is evident that the grid cannot be biased positively to any serious degree no matter how high a positive voltage is applied to it. This is prevented by the voltage drop across the high resistance R caused by a very small grid current.

AC Time-Delay Relays. Time-delay relays are more frequently used on ac than on dc circuits. Transformer secondaries replace batteries or resistor voltage dividers. Fig. 7 shows the connections for such a relay. Assume the transformer has the polarity shown. The tube cannot conduct because the — terminal of secondary S, S_1 connects to the anode. Current, therefore, tries to flow from anode to cathode, but the tube cannot conduct in this direction. Current to heat the cathode flows as indicated.

With switch D closed, current can flow from S_3 through R_1 back to S_2. Also by grid rectification (the grid acting as an anode) current flows from S_3 to the cathode and grid to charge capacitor C_1 to the polarity shown. Resistor R has a very high resistance so its current is very small.

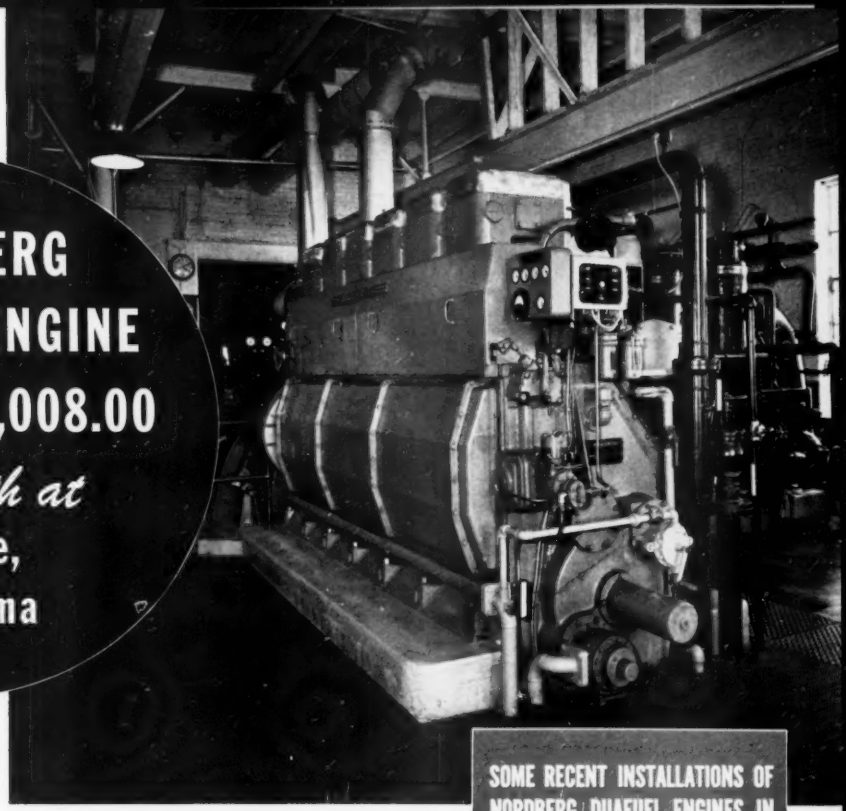
When transformer polarity reverses, S terminal becomes minus and is connected to the cathode, so the tube could conduct if the grid did not have a minus bias. Capacitor C_1, however, tends to discharge from the grid to cathode and from S_3 to S_2 in the transformer but cannot, so it maintains a minus bias on the grid to prevent the tube conducting.

Capacitor C_1 also discharges through resistor R but its resistance is so high that C_1 loses its charge slowly. As a result the capacitor remains nearly charged by grid rectification as long as switch D is closed, and the tube cannot conduct.

Capacitor Discharges. Opening switch D, as in Fig. 8, disconnects the grid from the transformer and capacitor C_1 gradually discharges through resistor R. It also tends to discharge from the grid to the cathode and through R_1. Consequently, it maintains a decreasing minus bias on the grid.

As this bias decreases, current flow through the tube increases until the relay closes as shown. The delay, from the time switch D is opened and the relay closes, may be 30 or 40 sec, so the polarity of the transformer may change many times. But capacitor C_1 cannot

NORDBERG DUAFUEL ENGINE *Saves* $1,008.00 *per month at* Okeene, Oklahoma



MUNICIPAL service at Okeene, Oklahoma, has grown from an annual generation of 640,760 K. W. in 1916 to 2,850,550 K.W. in 1948. Prior to last year's installation of an 840 H. P. supercharged Nordberg Duafuel Diesel engine, all power was generated with oil burning Diesels.

Plant Superintendent Sam Isbill reports that for the month of June, the Nordberg Duafuel Engine, burning gas fuel, saved $1,008.00 in the cost of fuel and lube oil compared with the oil fuel and lube oil cost of the oil burning Diesels. With this performance, the new engine will soon pay for itself in savings.

Speaking of the Nordberg Engine, Mr. Isbill states, "Our Nordberg Duafuel engine is doing a fine job and is showing a big reduction in operating expense."

Here, then, is municipal service that pleases both operating personnel *and* the taxpayers. Why not investigate the merits of Nordberg Diesel power?

SOME RECENT INSTALLATIONS OF NORDBERG DUAFUEL ENGINES IN MUNICIPAL POWER PLANTS

CULPEPER, VA.
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Nordberg two and four cycle engines are built in a wide range of types and sizes from 10 to 8500 H.P. Write for descriptive bulletin.

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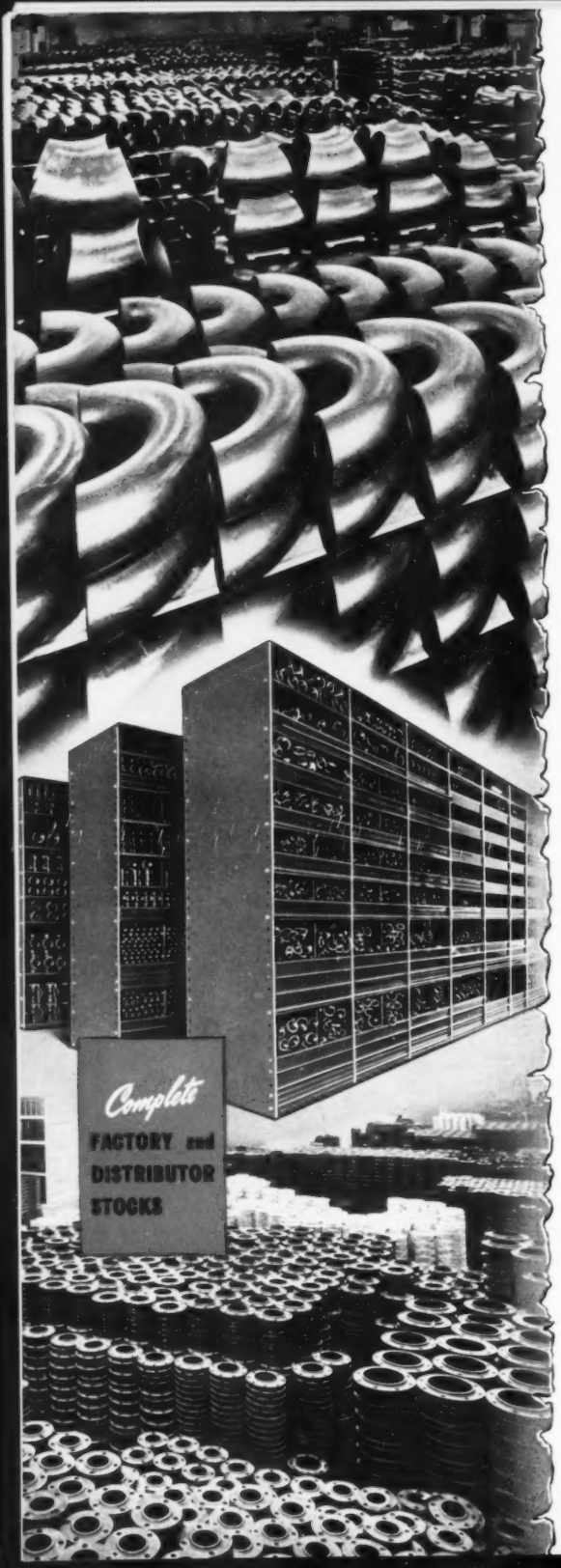
NORDBERG
DIESEL ENGINES



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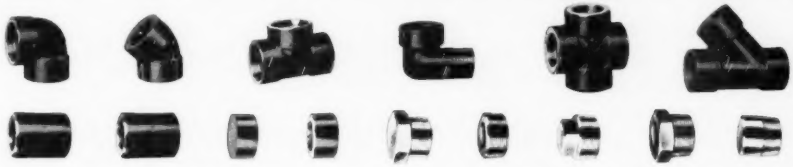
SEAMLESS WELDING FITTINGS—½ INCH THRU 30 INCHES

FORGED STEEL FLANGES—½ INCH THRU 30 INCHES—LARGE O.D. THRU 96 INCHES

FORGED STEEL FITTINGS—SCREWED AND SOCKET WELDING—⅛ INCH THRU 4 INCHES



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YOU CAN HAVE A

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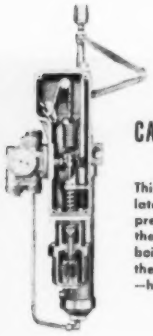
AT LESS COST TO OPERATE . . . .

1. INSTALL

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS



CASH STANDARD FUEL FEED CONTROLLER . . .

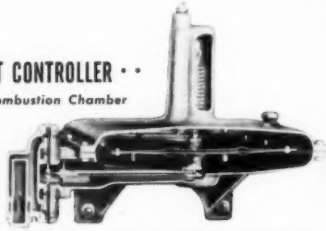
Automatically Regulates Fuel Feed

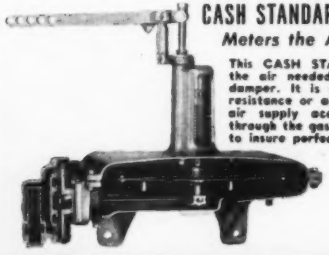
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion —hence, money saving.

CASH STANDARD FURNACE DRAFT CONTROLLER . .

Maintains a Constant Draft in the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.





CASH STANDARD AIR FLOW CONTROLLER . . .

Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

Write today for Bulletin No. 300.

2. GET

AUTOMATIC REGULATION OF FUEL FEED

METERED AIR NEEDED FOR COMBUSTION

A CONSTANT DRAFT MAINTAINED IN THE COMBUSTION CHAMBER

3. REALIZE

MORE STEAM FROM YOUR PRESENT BOILER

LESS FUEL - COAL - OIL - GAS
LESS COSTS
SAVINGS IN MAINTENANCE . .

whether you have a single boiler or battery of boilers

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

"15 Years Service... Only 5 Hours Down-Time"

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VOLTAGE REGULATORS

THAT'S THE RECORD of our Allis-Chalmers Rocking Contact Voltage Regulators," says the Chief Engineer of a large industrial laundry.

"And our regulation is good! The old regulator wouldn't hold within 50 volts on our varying loads. We had trouble all the time with under-voltage relays kicking out. With our Allis-Chalmers Regulator, variations are ironed out in a fraction of a second — and our equipment keeps running."

Low Maintenance, Accuracy, Instant Response and *Dependability* — these are the results of Rocking Contact design. There are no vibrating contacts and no gliding friction to hinder accuracy and response. No complex adjustments to make — *simplicity* means years of trouble-free service for you!

Rocking Contact Voltage Regulators are available for both a-c and d-c generators of any size and speed, for either parallel operation or unit control. Call your nearby A-C office, or write direct.

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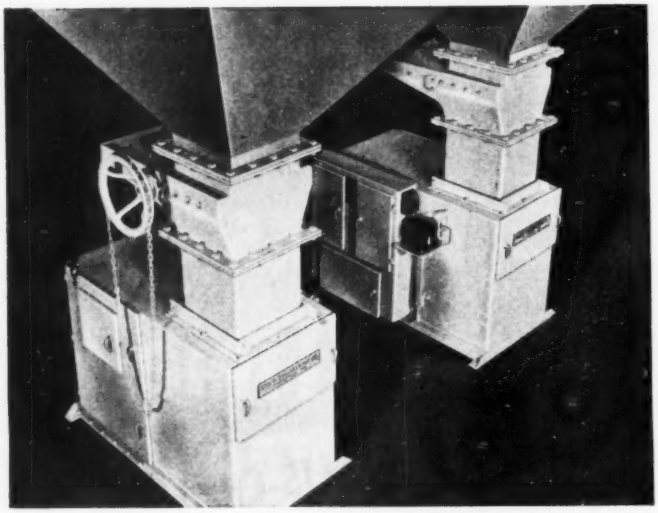
OTHER ALLIS-CHALMERS SPECIAL CONTROL

SYNCHRO-OPERATOR — Automatically synchronizes alternating current generators, tie lines, synchronous condensers, etc.

D.C. POSITIONER — Operates from power plant d-c bus, used for remote indication, control, order telegraph, etc.

REGULEX CONTROL — Used where the features of a rotating type regulator are desired.

Regulex is an Allis-Chalmers trademark.

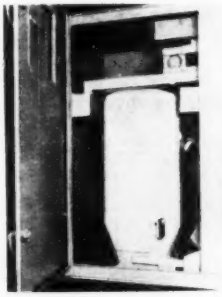


LOW MAINTENANCE COSTS ARE ASSURED

with S-E-CO. COAL SCALES

Large assembly door and feeder access door make it possible to remove the feeder and weigh hopper quickly as units. If the feeder support rails are also removed, the inside of the coal scale body is entirely free of operating parts. The inside of the scale is then clear for cleaning and painting. If this work is done occasionally, the scale body should last indefinitely.

The sub-assembly idea is exclusive with S-E-Co. Coal Scales. This is another reason why these units will give the best coal scale operation.



Send your inquiry to

STOCK ENGINEERING COMPANY

715P Hanna Building ★ Cleveland 15, Ohio

recharge by grid rectification because switch *D* is open. Therefore the capacitor gradually loses its charge through resistor *R* and the relay closes.

As explained in the August article, capacitor *C* is charged of a polarity shown. On reverse transformer polarity, when the tube cannot conduct, the capacitor discharges through the relay coil to hold the contacts closed.

The next article will continue our study of ac time-delay relays.

Technical Briefs

(*Continued from page* 140)

surveys in over 100 cities in 23 states and Canada.

The BCR conducts a field activity in the form of overfire air jet clinics. These have been run in eleven cities including one city in Canada. The objective is to provide both combustion engineers and smoke inspectors with a fuller understanding of how to go about selecting and installing overfire jets. *SPA paper. No number.*

A Smoke Official Looks at the Stoker, *by J H Carter, St. Louis, Mo.* The single-retort underfeed stoker presents the only legal means of burning high-volatile coals in communities where smoke ordinances forbid hand-firing of coals above a certain volatile content. Where this stoker has gone into homes it has not been the cause of many complaints. With perhaps the exception of clinker-removal periods the underfeed stoker presents as clean an appearance as any in the neighborhood.

But what about commercial installations? To achieve the same good results as domestic units the St. Louis Smoke Regulation Dept felt certain specifications had to be set up. These "specs" cover sizing, class of coal, combustion volume, flame clearance, clinker space and similar items.

Once these specifications are drafted and agreed upon by stoker manufacturer, dealer and City Smoke Dept all should work well. Often it doesn't. Here is why. Too much faith is put in the janitor's firing ability and too often the commercial stoker has no controls, nor hold-fire settings. The major task for the stoker industry is to see that all commercial equipment has the proper controls and range of settings to give automatic heat and operation. *SMA paper. No number.*

Plant Problems

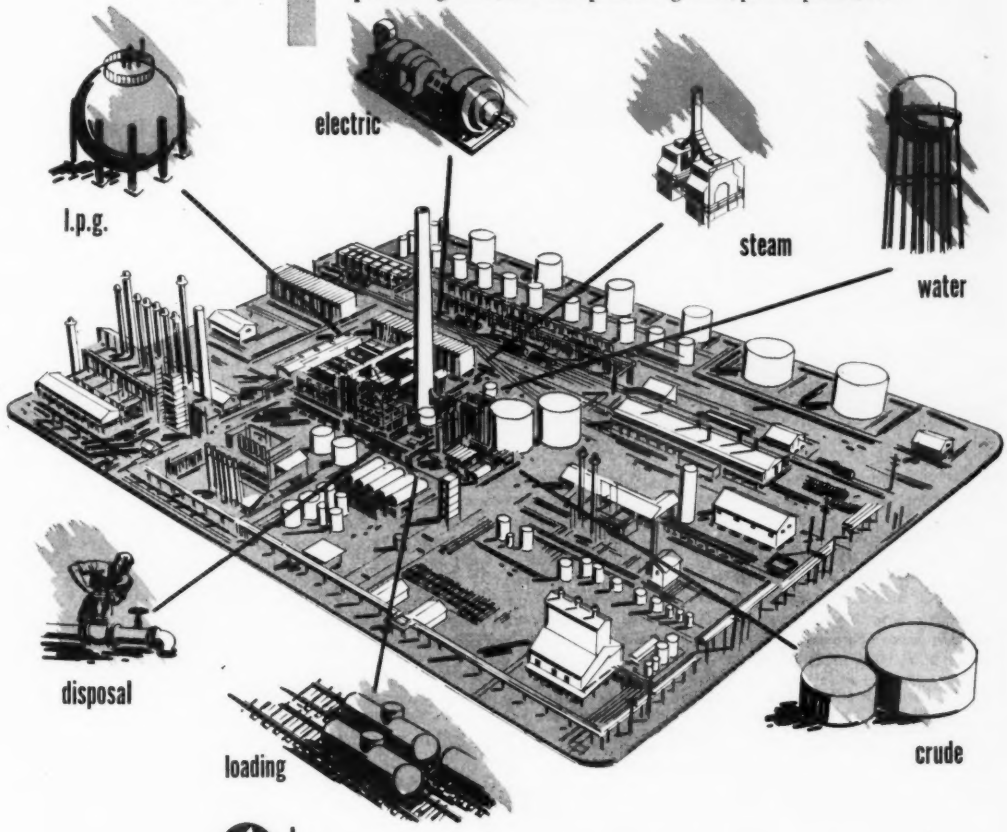
(*Continued from page* 136)

To test the pump valves close both suction and discharge valves. Remove cylinder cover plates and piston packing. Then apply water pressure

Fluor designs off-site facilities too

Whatever your Off-Site requirements—balanced steam and electrical systems . . . interconnecting process piping and rack structures . . . water disposal and fire protection systems . . . roads, rail spurs and loading racks for product handling . . . warehouses and tank farms for storage—Fluor will design, construct and install these facilities for maximum efficiency and economy.

Experienced Fluor Engineers, together with permanently employed Fluor key construction personnel, are available to handle any or all Off-Site Facility work necessary for successful on-stream operation of refineries, gas-gasoline processing units, chemical processing units, power plants, etc.



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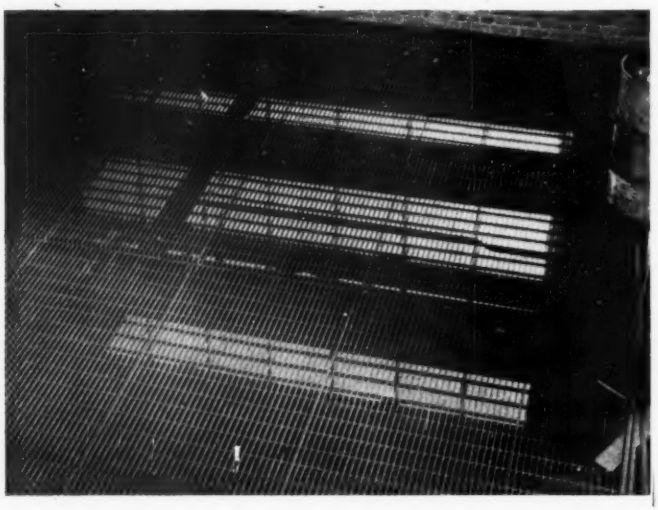
Where light and air are essential

specify Hendrick Mitco Open Steel Flooring



The illustration shows an installation where the 90% open area of Hendrick Open Steel Flooring permits the passage of ample light and air through three floors.

In hundreds of factories and power plants, in city subways, on shipboard, hundreds of thousands of square feet of this flooring have given long years of satisfactory service because of outstanding Hendrick Mitco advantages.

Of pressure-formed integral construction, there are no bolts, rivets or angle irons to loosen or weaken, or to form projections to catch dirt and obstruct passage of light.

The square-edge, uniformly spaced steel bars provide a level, non-slipping walking surface. Because every Mitco panel is a strong, integral unit, there is no lateral deflection of the flooring, however heavy the load.

HENDRICK SHUR-SITE TREADS for stairs, ladders and fire escapes, have the level walking surface of Hendrick Open Steel Flooring and other Mitco advantages. A heavy, flanged nosing-bar that makes the edge of each tread clearly visible is a valuable safety feature and also gives reinforcement where the load is greatest.

HENDRICK ARMORGRIDS are unequalled for floors, loading platforms, ramps and driveways that have to withstand heavy traffic.

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Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

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Sales Offices In Principal Cities

through tapped opening in top of pump. If discharge valves are leaking, water flows out through cylinder openings. Replace cylinder cover plates and disconnect suction line. Remove top of pump and take out one discharge valve on each end of pump. Replace top of pump and apply water pressure; if water starts out of pump suction line, suction valves are leaking.

In my experience with piston-packed pumps we have far more trouble with packing wearing out than with valve leakage. With such leakage we get a quick stroke on pump and it is easy to determine on just which end the valve is leaking. We find at times that pump trouble is caused by both piston packing and cylinder linings being worn. It is poor practice to put in good piston packing with worn cylinder linings.

G G AVANT *Wilmington, N. C.*

Find Maximum Pressure

SLIP TEST DOES NOT TELL whether piston or valves are leaking, but shows total leakage. If pump does not have relief valve, find maximum discharge pressure as follows:

$$W_p = \frac{A_s \times S_p}{A_w}$$

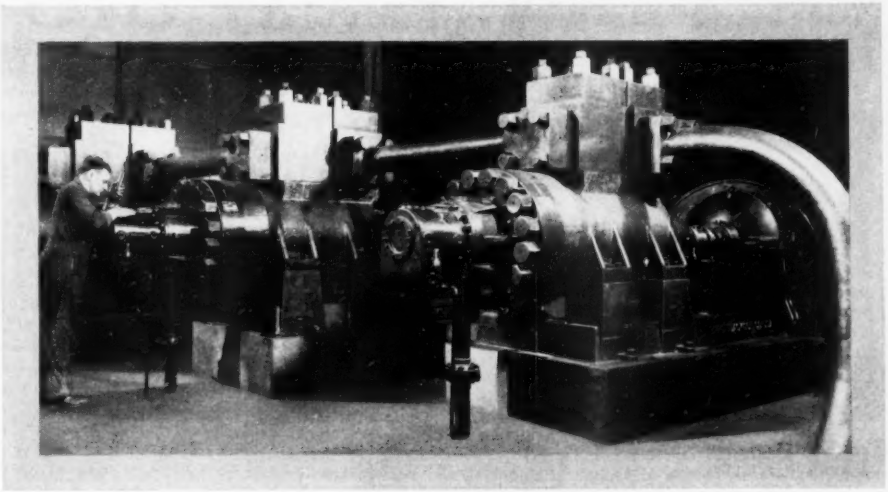
W_p = maximum discharge pressure that can be developed
A_s = area of steam piston
S_p = steam pressure
A_w = area of water piston

If resulting pressure is too great for safety, install relief valve.

Make slip test as follows: Close discharge stop valve and open suction stop valve. Remember, stop valves are gate or globe valves on pump piping. If pump has governor for maintaining constant discharge pressure, and if governor control connection is between discharge pump valves and discharge stop valve, simply admit steam to pump. Note that pump valves are internal; they open and close with each pump stroke. If pump does not have such a governor install pressure gage between discharge pump valves and discharge stop valve. Manipulate throttle to maintain discharge pressure. In either case, pump motion equals slippage.

To test discharge pump valves, first close suction stop valve, take out cylinder drain plugs, then let water drain out. Admit water at discharge pressure to discharge side of pump. Leakage through pump discharge valves can be seen coming out cylinder drain plug holes.

An opening in suction pipe between pump and suction stop valve is necessary to test suction pump valves. First close suction stop valve, then block open a discharge pump valve at each end of cylinder. Admit water at dis-



GULF HARMONY OIL *selected*

for the World's Largest Industrial Centrifugal Pumps

to insure top performance, long life

Largest pump capacity in terms of pressure and volume of any industrial centrifugal pump installation in the world is found in the hydraulic system of the 18,000-ton forging press at Wyman-Gordon Products Corporation. Capacity is 1500 gal. per min. at 5300 lbs. per sq. in. — enough energy to pump the water contained in twelve tank cars in one hour from sea level to the top of Mount Whitney (altitude 14,510 ft.)

This unusual installation consists of three 8-stage units connected in series. Pressure increase through each pump is 1750 lbs. per sq. in. Each is driven by a 1,000 hp motor, and has an individual lubricating system which supplies Gulf Harmony Oil, noted for its successful performance under heavy loads, to the pump and motor bearings. Gulf Harmony Oil is rust and foam inhibited and has outstanding resistance to oxidation—helps insure long trouble-free pump and motor life.

Another outstanding installation of power plant equipment for which a Gulf quality lubricant was selected! Make sure your plant is getting the advantages of all recent developments in scientific lubrication. Write, wire, or phone your nearest Gulf office today and ask a Gulf Lubrication Engineer to call.

Gulf makes available top quality passenger and truck tires—Ask your Gulf representative

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Division Sales Offices:

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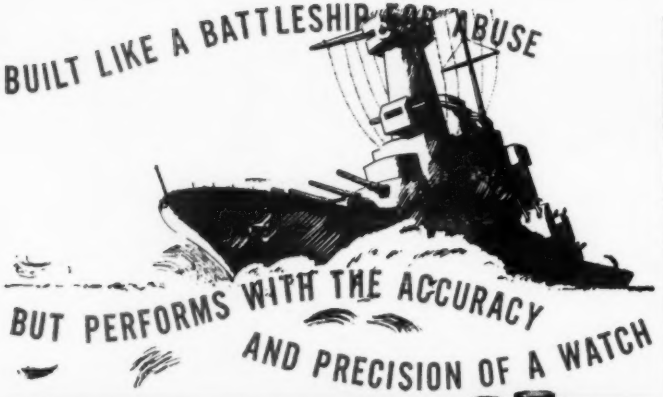
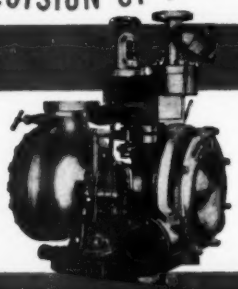
GULF INDUSTRIAL LUBRICATION



COFFIN

Turbo Pumps Deliver 3-to 12-Stage Pump Performance



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COFFIN PUMP REPRESENTATIVES SERVE ALL OF AMERICA'S INDUSTRIES

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The H. Berry-Detroit Company, Detroit, Michigan
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Fuel Economy Engineering Co., Saint Paul, Minnesota
J. W. Himmelsbach, Chicago, Illinois
International Railway Supply Co., New York, N. Y.
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FREE

A complete 4-page illustrated bulletin on COFFIN TURBO PUMPS with all operating data, applications, specifications, that you may require for your next job. Write for Bulletin "S" today.

165

INDUSTRIAL RAILROAD COFFIN MARINE

The J. S. COFFIN, JR., COMPANY

326 SOUTH DEAN STREET, ENGLEWOOD, NEW JERSEY

charge pressure to discharge side of pump. Leakage through suction pump valves will come out suction-pipe opening.

Above tests are seldom made in practice. An experienced mechanic can generally tell from appearance of piston and valves if there is undue leakage.

A HOLT *Atlantic City, N. J.*

CONDENSER-TUBE ALLOYS

(Continued from page 117)

graph, page 116, shows a typical summer daily load curve for a system supplying considerable industrial load. Total system capacity is 200,000 kw. When the 50,000-kw unit goes off the line the system cannot supply any load greater than 150,000 kw. This means it loses revenue for about 12 hr of the day, or for about 484,000-kwhr load. During the other hours of the day, the outage loss consists of increased fuel and supply costs because of operating less efficient units.

Table V shows how to calculate the outage loss for this condition. It is assumed that the load curve illustrated occurs on only five week days per week, and that Saturday and Sunday load curves are all below 150,000 kw.

Table IV shows how the total annual costs compare for this condition, assuming that all the items are the same as in Table II, except the outage charge. Here again the differential is small, but in favor of the higher-cost alloy *C*. Other considerations will again determine the selection.

Longer Lives. Now let's consider a case where investments and salvage values are the same as in Table II, but that the lives of *A B* and *C* are respectively 8, 10 and 12 years. The calculations are given in Tables VI and VII. Here the maximum difference is between *A* and *C*, $530 annually equal to 10.6% of total annual costs. This is a significant difference in favor of the higher-priced alloy. The difference is also in favor of *C* compared to *B*.

Again, let's look at a sidelight condition and assume that all outage is chargeable to the condenser. Then the figures shown in Table VII can be used by simply adding twice the annual outage cost:

A	*B*	*C*
$5520	$5290	$4990
3500	2920	2520
$9020	$8210	$7510

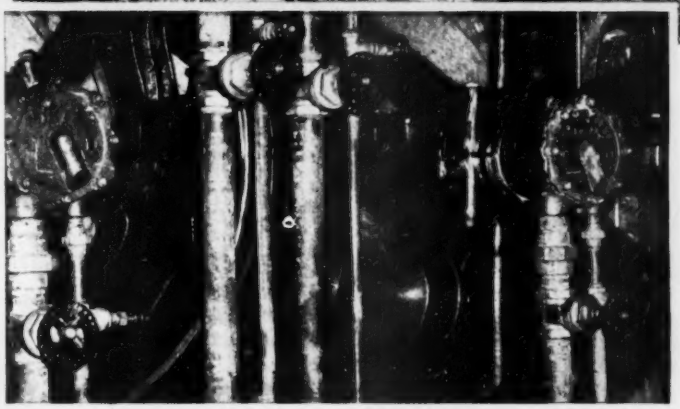
For this condition alloy *C* saves $700 per year over *B* and $1510 annually over alloy *A*. So *C* should be selected if no other consideration supersedes the financial one in importance.

OIC VALVES
SLASH MAINTENANCE COSTS FOR SONOCO PRODUCTS CO.

In the Hartsville, S. C., plant of Sonoco Products Co., OIC Valves play an important part in the manufacture of such paper specialties as textile cones, mailing tubes, drug cans, electrical tubes, fuse tubes, spools and paper mill cores.

•

Most of the small valves shown here on a Sonoco paper machine are 2-inch size. Other OIC Valves, in a wide variety of trims and sizes, are used on lines for such varied services as Paper Stock, Paste, Steam Power, Process Steam, Compressed Air, Water, Fuel Oil and Air Conditioning Equipment.



SONOCO, one of the nation's leading manufacturers of paper specialties, has learned that OIC Valves cost less, over the years, than any other valves. Sonoco's own long-kept maintenance records furnish the proof!

Reasons? Plenty!

OIC Valves feature heavier construction to control pressures and stresses safely! Their streamlined design protects the flow from turbulence. Leakproof joints guard against pressure drop. Wedges of heavy I-Beam design control the flow with positive action. Integral body ribs are precision-designed — effectively reduce vibration and wear.

All these and many more outstanding features tell why Sonoco and hundreds of other leading valve users find OIC the "Pace-Setter in Valves"!

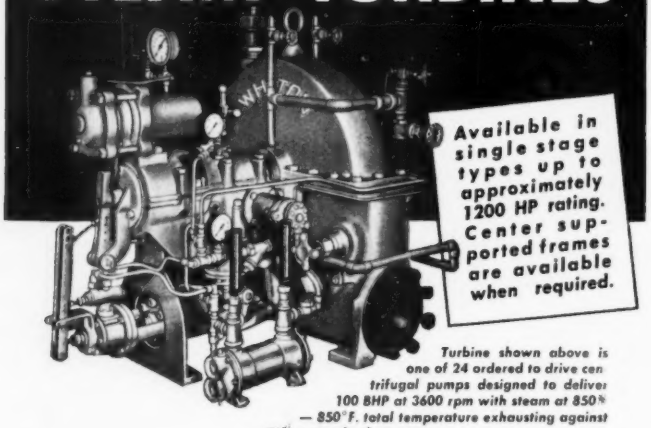
SEND FOR YOUR FREE COPY OF OIC'S VALUABLE VALVE CROSS REFERENCE CHART

Easy to use — saves you time and money! Simply check the number of the valve you wish to replace, look in the chart, and you'll find the right OIC valve. Write to The Ohio Injector Co., Wadsworth, Ohio for your free copy.

OIC
SETS THE PACE IN VALVES

STEEL • IRON • BRONZE

Whiton SOLID STEEL ROTOR STEAM TURBINES



Available in single stage types up to approximately 1200 HP rating. Center supported frames are available when required.

Turbine shown above is one of 24 ordered to drive centrifugal pumps designed to deliver 100 BHP at 3600 rpm with steam at 850° — 850° F. total temperature exhausting against 42# gauge back pressure.

• SIMPLE DESIGN FOR ACCESSIBILITY

Inlet and exhaust connections are located in lower half of casing which is horizontally split to allow easy access to all internal parts. Rotating unit including bearings and governor head may be removed without disturbing alignment of the unit.

• RUGGED CONSTRUCTION FOR RELIABILITY

Whiton rotors are made from a solid steel forging with semi-circular buckets milled in the rim to give strength where it is needed. End thrust is minimized because the path of the steam is always at right angles to the shaft.

• SAFETY DEVICES FOR TROUBLE-FREE OPERATION

Standard equipment includes Constant Speed Governor with V-Ported Governor Valve . . . Emergency Governor with Independent Valve . . . Steel Plate Steam Strainer . . . Two oil rings per bearing supplemented by water cooling . . . Sentinel Type Casing Relief Valve . . . Additional accessories available as required.

THOUSANDS OF SATISFACTORY INSTALLATIONS SINCE 1911

Write for complete information

Whiton since 1856

WHITON MACHINE COMPANY

NEW LONDON, CONN., U.S.A.

also makers of fine Lathe Chucks • Gear Cutting Machines • High Production Milling Machines • Centering Machines

NEW EQUIPMENT

(*Continued from page 154*)

Semi-enclosed, nonclogging type of impeller permits passage of usual size solids encountered in dewatering service. Impeller is adjustable for wear. Pump casing is bolted to heavy-duty support head. Shaft operates in two deep-grooved, oversized ball bearings to resist severe service.

All stationary models are equipped with electric motors of proper characteristics. The portable type has a 1½-hp, 4-cycle, air-cooled gasoline engine.

Deming Co, Salem, Ohio.

P986 • REVERSIBLE RATCHET WRENCH—*Favorite "De Luxe"* heavy-duty reversible ratchet wrench takes load with all working parts in compression, eliminating danger of pawl breakage.

Synthetic-rubber ring holds socket in place. It makes head change easier than with setscrew. Each double head has two nut sizes.

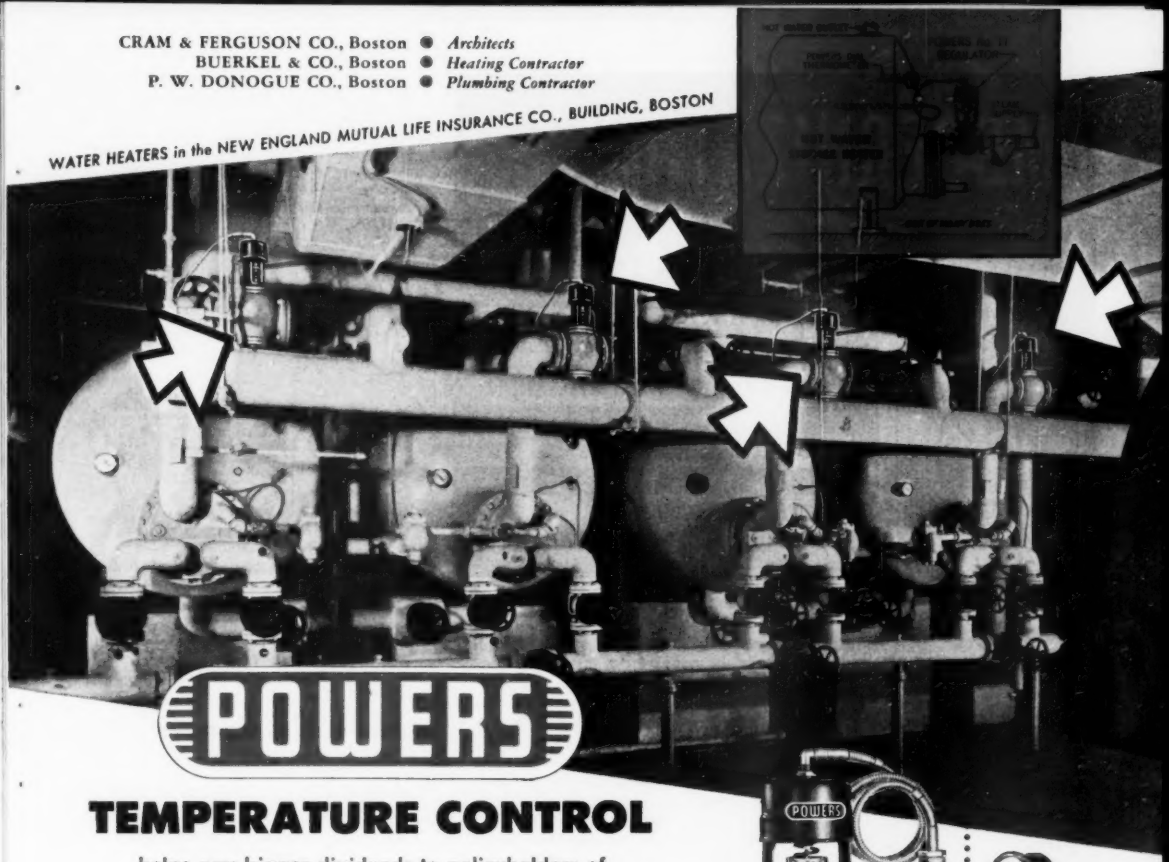
Greene, Tweed & Co, North Wales, Pa.

P987 • LUBE-OIL RE-REFINER — Automatic unit uses catalytic process, high temperatures, subatmospheric pressures and complete filtration to remove carbon, acids, metal particles, water and dirt from diesel crankcase oils, making them suitable for re-use.

Device is 25 in. in diameter, 44 in. high

CRAM & FERGUSON CO., Boston ● *Architects*
BUERKEL & CO., Boston ● *Heating Contractor*
P. W. DONOGUE CO., Boston ● *Plumbing Contractor*

WATER HEATERS in the NEW ENGLAND MUTUAL LIFE INSURANCE CO., BUILDING, BOSTON



POWERS

TEMPERATURE CONTROL

helps pay bigger dividends to policyholders of New England Mutual Life Insurance Co.

Saves Fuel and Prevents OVER-heating—Fuel savings alone often pay back the cost of Powers regulators on water heaters 3 to 6 times a year. They put an end to hot water complaints.

Users Report 15 to 25 Years of Dependable Service—Because of their simplicity of design and durable construction Powers regulators are famed for their year after year low cost, trouble free service.

Complete Line of Controls—Self-acting and water operated regulators and air-operated indicating and recording controllers for:

INSTANTANEOUS HEATERS • FUEL and CRUDE OIL HEATERS
TWO-TEMPERATURE SERVICE HOT WATER SYSTEMS
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When You Need Help on your problems of temperature and humidity control take advantage of our 58 years of experience in this field . . Contact our nearest office.

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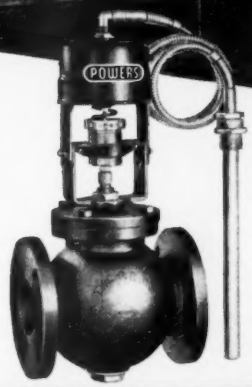

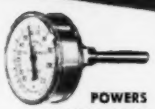

POWERS EASY TO READ DIAL THERMOMETER
Used on heaters shown above.

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At Left: **Regulator with flanged iron body balanced valve, sizes 2½ to 6″**

No. 11 REGULATORS
Self-Acting

Right: **Bronze body balanced valve with union connections, sizes ½ to 2″. Single seat valves with union connections ½ to 1½″. 3-Way valves for mixing hot and coldwater. Indicating Regulators with dial thermometer. Stem Lubricator and Safety-Over-heat protection standard on sizes to 2″incl.**

Phone or Write nearest Office for

1184

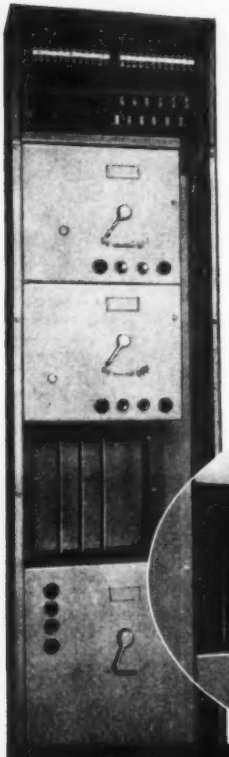
MODERNIZATION *Demands...*

G-E Motor Control Centers

for EASY, LOW-COST INSTALLATION

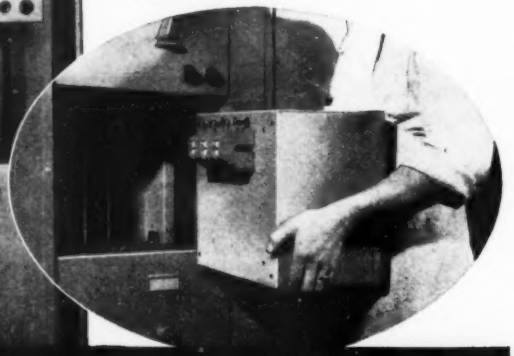
FLEXIBLE ARRANGEMENT

SIMPLIFIED SERVICING



These advantages, plus many more, are yours when you buy economical, G-E motor control centers. Only 12 inches deep, front connected, pre-engineered, can be factory assembled, wired, and tested. Individual sections can hold combinations of two or more sizes of starter units. (NEMA Size 1, 2, 3, and 4 for 1 to 100-hp a-c motors, 440 volts or below). Standard starters in standard vertical sections simplify installation, servicing, and stocking spare parts, yet permit flexible arrangements.

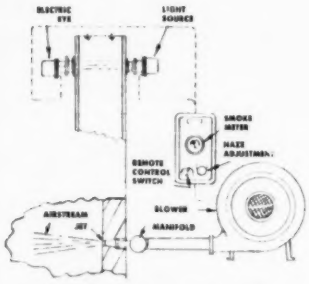
In addition, each unit is "wrapped in steel," has built-in short-circuit and overload protection. Wiring troughs are five inches wide, terminal and incoming bus may be at top or bottom as you prefer—all easily accessible. Wiring time is cut because "clothespin contacts" (below) connect to incoming power in one quick shove. Write now for more details in Bulletin GEA-4979. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*



GENERAL ELECTRIC

and weighs 300 lbs. It can operate on 110 or 220 v, 60 or 25 cycles, single or 3-phase ac. Capacity is 3.5 gal at one time. Refining cycle varies with viscosity of oil but daily capacity of 100 gal per 8-hr shift can be regarded as a reasonable average.

Automatic Oil Refiners, Inc, Orchard Park, N. Y.



P988 • OVERFIRE AIR JET—Non-continuous, centrifugal blower supplies air to overfire jets through either a single or double manifold.

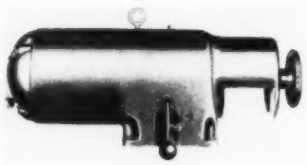
Controls may be manual or automatic. A pushbutton station gives manual control of the blower. A photoelectric cell in the stack connects to the blower starter for automatic operation.

Eclipse Fuel Engrg Co, Rockford, Ill.

P989 • CARBIDE GLASS DRILL — Sizes of carbide-tipped glass drills range from ⅛ to ½ in. Two-flute design eases sharpening, lowers price.

Drills glass tile and other ceramics.

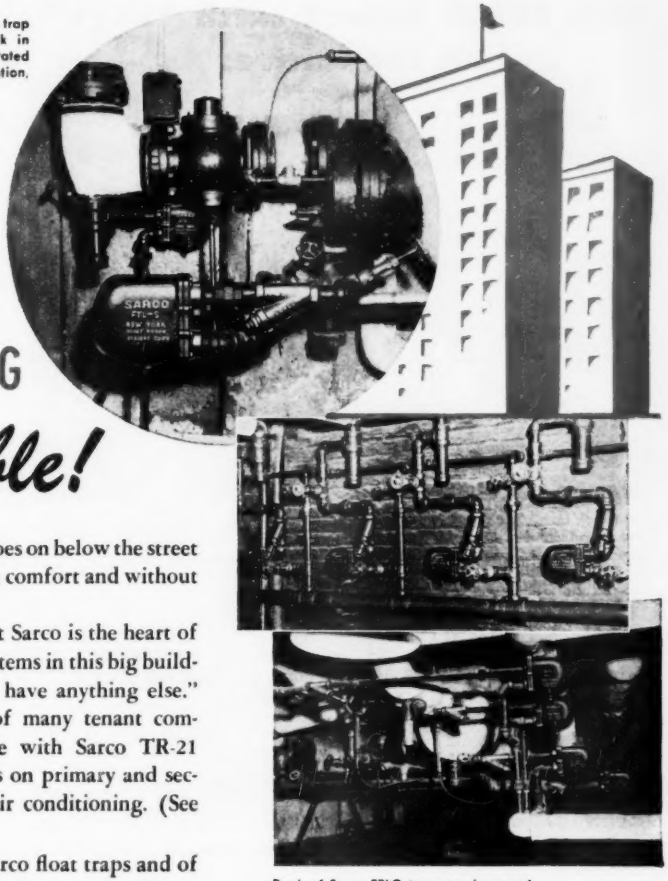
Super Tool Co, 21650 Hoover Rd, Detroit 13, Mich.



P990 • GEAR-SHIFT DRIVE — Type *R4* is a self-contained unit combining motor and a 4-speed transmission designed to individually motorize machine tools formerly driven from line shaft. Drive has gear ratios as follows: Low, 4-1; Second, 2-1, Third, 1.33-1; High, 1-1.

Units are built with four speeds in ratings of 3 hp at 900 rpm to 10 hp at 1800 rpm, and with eight speeds in ratings of 1½ hp at 1200/600 rpm to 5 hp

Sarco TR-21 control and Float trap on 1300 gallon storage tank in the Equitable Building, operated by The Real Estate Corporation, Chicago.



HOW SARCO KEEPS A BIG OFFICE BUILDING *Comfortable!*

Few office workers realize what goes on below the street level in order that they may work in comfort and without interruption.

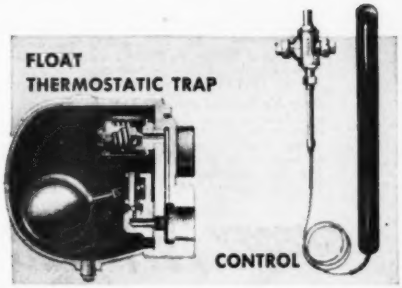
But the engineer can tell you that Sarco is the heart of the heating and air conditioning systems in this big building. In fact, he says he "wouldn't have anything else."

Hot water service, the source of many tenant complaints, is controlled to a degree with Sarco TR-21 regulators, float traps and strainers on primary and secondary tanks—including one for air conditioning. (See illustrations)

A bank of risers is dripped by Sarco float traps and of course Sarco radiator traps are found on every radiator.

Engineered primarily for service, such a system also results in minimum fuel consumption.

Bank of Sarco FTLO traps on risers and TR-21's on storage tank and heater



YOU CAN HAVE THIS SERVICE TOO . . .

It sounds simple, and yet hundreds of buildings are still handicapped by impossible heating hookups; noisy radiators, some areas too hot, others too cold, hot water complaints all day long, and a fuel bill that is 10 to 20% higher than it should be.

The Sarco Representative near you will look over your building without obligation. You will be surprised to see how much can be done and how little it will cost.

223

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
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SARCO CANADA, LTD., TORONTO 5, ONTARIO

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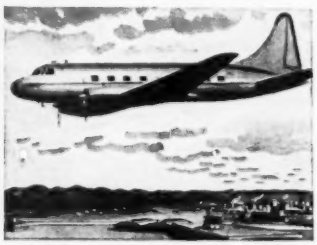
That low $3.58 figure was total cost for Air Express and included door-to-door service. That makes the *world's fastest* shipping method exceptionally convenient, complete, and easy to use.



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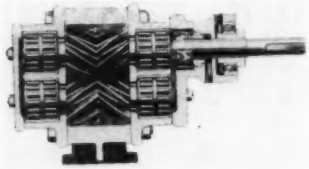
at 1800/900 rpm. Unit is instantly reversible in all speeds by using the motor-reversing control.

Four-speed gear-shift drives are furnished for operation on 2- or 3-phase, 25-, 50- or 60-cycle, 220-440 or 550-v ac power supply.

Dept AB 59, Lima Electric Motor Co, Lima, Ohio.



P991 • GEAR ROTARY PUMPS — They are especially adapted to overhung multi-V-belt or other drives that impose unusual radial load on rotary pump shaft. Inboard bearing construction takes load off main pump bearings, resulting in longer life and a more rugged pump.

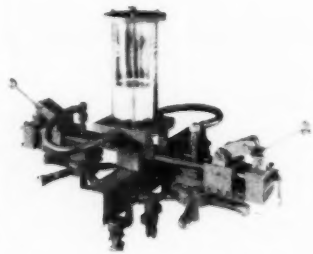
The bearing is an adapter type designed so that inner race is locked to drive shaft, close to load center. This eliminates necessity of the user installing separate outboard pedestal bearings and base. A drip-proof mechanical seal automatically adjusted and subject to suction pressure only, makes the pump suited to high-pressure or high-vacuum services.

Worthington Pump & Machinery Corp, Harrison, N. J.

P992 • AIR-CONDITIONING SLIDE RULE — *Psychometric Selector* has no log scales or confusing criss-cross lines. Printed numbers on sliding card are read directly through window for simple determination of air conditions from reading of dry- and wet-bulb temperatures.

Heavy card stock is varnished for protection.

Nickerson & Collins Co, 433 N Waller Ave, Chicago 44, Ill.



P993 • GREASE LUBRICATOR — Self-contained grease lubricator for conveyors requires no external power for operation. Transparent plastic reservoir also serves as a liquid-level gage. A quick-release lever takes lubricator out of service and a spring follow-up or air pressure on reservoir forces lubricant into pumping unit.

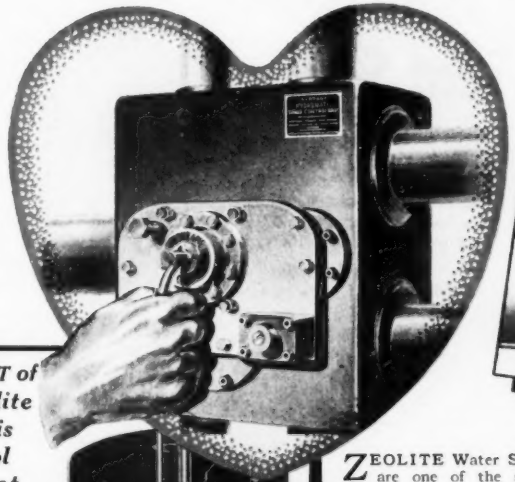
As trolley wheel approaches lubricator the hub engages sleeve of one of the five

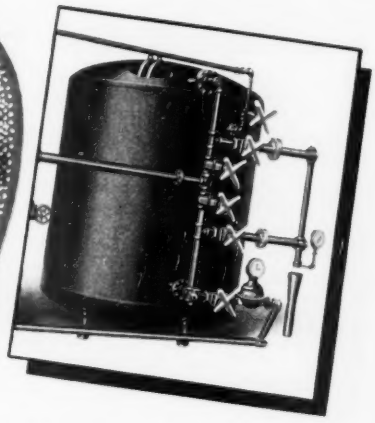
ONLY COCHRANE ZEOLITE WATER SOFTENERS have the HYDROMATIC *Single Control* VALVE

The Valve That Reduces Costs, Speeds Softening Operations and Insures Accuracy of Operation

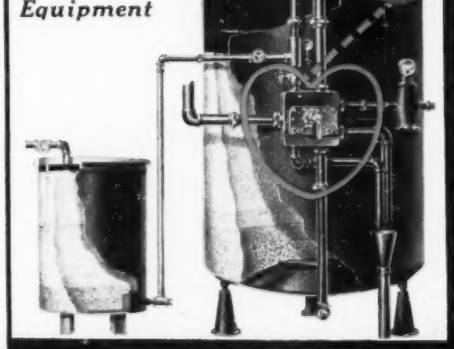
PATENTS APPLIED FOR

COCHRANE CORPORATION 86 YEARS OF SERVICE 1863-1949





The HEART of every Zeolite Softener is its Control Equipment



ZEOLITE Water Softeners are one of the standard pieces of processing equipment in all industries where hard water is a problem. Cochrane has been one of the leaders in this field for over half a century. Much of the progress in industrial water conditioning has been due to Cochrane engineering.

And now Cochrane introduces a new improvement in Zeolite Water Softening—the Hydromatic Single Control Valve, standard equipment only on Cochrane Zeolite Softeners.

This exclusive feature is really six valves in one, combining in a single unit four service positions and two stand-by positions—service, backwash, brine and rinse as well as isolation of the container from service lines and draining to bed line for inspection.

The Valve is pilot-operated, power being supplied by the raw water itself. Operation is smooth and effortless, hydraulic shock being completely eliminated.

The Hydromatic Valve thus reduces time on the part of the operator, minimizes possibility of error and cuts down on space requirements.

Write for bulletins on Zeolite Softeners and the Hydromatic Valve.

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COCHRANE

SOFTENERS • FILTERS • DEAERATORS • SPECIALTIES

COCHRANE CORPORATION
3106 N. 17th Street, Philadelphia 32, Pa.

Please send bulletin describing Cochrane Hydromatic Zeolite Softener

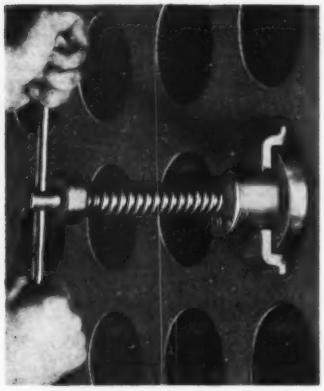
Name_____

Firm_____

Address_____

City_____ State_____

48 man-hour job done in only 4 hours with a ROTO Hand-hole Seat Scraper



Illustrating ease of operation of Roto Hand-hole Seat Scraper.

If you operate any of the boilers listed below, you can't afford to be without a ROTO Hand-hole Seat Scraper.

A Pennsylvania manufacturer reports that it formerly took three men 2 to 3 days to clean inside cap seats on a Keeler Boiler header. Now, with a ROTO Hand-hole Seat Scraper, one man does it in four hours, besides doing a better job.

This simple, hand-operated tool is equipped with retractable knives mounted on the end of a revolving spindle having a bearing in a substantial yoke. An adjustable spring automatically maintains tension on the knives, sufficient to remove all foreign matter but not enough to cut the metal. A few turns to the right, and the job is done. A half turn to the left releases the tool. Write for bulletin and prices.

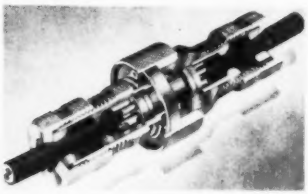
MAKE OF BOILER	TUBE SIZE	OPENING
Babcock & Wilcox	4"	Oval
B. & W. No. 40 Header	3¼"	Oval
B. & W. No. 41 Header	2"	Oval
B. & W. Superheater	2"	Round
Babcock & Wilcox	4-13/16x5"	Square
Casey Hedges	4"	Oval
Casey Hedges	3½"	Oval
Combustion Engineer'g	3"	Round
Edge Moore	4"	Oval
Franklin	4"	Round
Geary	4"	Oval
Heine	3½"	Oval
Heine	3½"	Round
Keeler	4"	Round
Keeler	4"	Diamond
Murray	4"	Oval
Murray	3½"	Oval
Oil City	4"	Oval
Oil City	3½"	Oval
Union Iron Works	4"	Pear Shape
Walsh & Widener	4"	Oval

ROTO Hand-hole Seat Scraper for Heine Boiler.

ELLIOTT COMPANY-ROTO DIVISION

153 Sussex Avenue Newark 1, N. J.

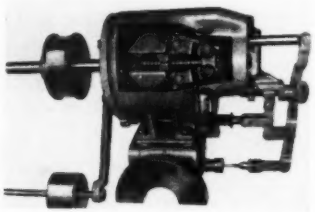
pumping units that is automatically brought into contact with wheel bearing. Continued rotation of lubricator forces pumping unit inward, delivering a measured quantity of lubricant through the fitting to wheel bearing.
J N Fauver Co, 49 W Hancock St, Detroit, Mich.



P994 • ELECTRICAL CONNECTOR —Quick-disconnect electrical coupling is for all-weather and submarine applications. A quarter turn is all that is needed to make or break coupling. No tools are required.

Series 1600 couplings are provided with either pressure-type cable seals or threaded for attachment to conduits, bulkheads or panels. Coupling is manufactured in bronze alloys and is available in a wide range of sizes.
Roylyn, Inc, 718 W Wilson Ave, Glendale 3, Calif.

P995 • SPRING-ANALYZER — Hydraulically operated, precision measuring device reads rates of compression springs from ½ to 6 in. long, or tension springs 1 to 22 in. long; up to 3-in. dia. Rate readings are given in lb per sq in. on a pressure scale that reads from 0 to 300.
Storm-Vulcan, Inc, Dallas, Texas.



P996 • ENGINE GOVERNOR — Control of steam-engine speeds over ranges of 2 to 1, 4 to 1 or 6 to 1 can be had with Type *EN* throttling governor. Engine speed can be varied either at the governor or from a remote point, manually or automatically.

Mechanism is totally enclosed and completely self-lubricating. Horizontal shaft eliminates customary bevel gears. Ball bearings throughout assure maintaining full sensitivity.

Further features include: automatic

For men who work with heat or cold

"Armstrong's Insulator" is a bimonthly magazine published by the Armstrong Cork Company as a service to men who work with high, medium, and low temperatures. Much of the editorial material contained in the "Insulator" is developed from Armstrong's work in the solution of problems involving the use of insulations to control heat and cold.

The list at the right of this page will give you an idea of the variety of subjects discussed in recent issues. Some were comprehensive reports on an entire industry or a new method of using heat or cold. Others were engineering articles, outlining with facts and drawings the technical details of good insulation practice.

If you would like to read any of these articles, we will be glad to send you the copies of "Armstrong's Insulator" in which they appeared. Just write to Armstrong Cork Company, 7009 Maple Avenue, Lancaster, Pennsylvania.

ARTICLES FROM RECENT ISSUES OF "ARMSTRONG'S INSULATOR"

LOW TEMPERATURE

Synthetic Fiber Manufacture
Fur Farm Cold Rooms
The Meat Industry
Eyeglass Lens Production
Seed Storage
Tomato Ripening and Storage
Railroad Car Freezer
Freezers on Trawlers
Manufacture of Insulin
Hotel Chefs' Kitchens
One Story Bakery Design

LOW-TEMPERATURE EQUIPMENT

Refrigerated Display Cases
Automaton Selling
The House Trailer Industry
What's Happening in Refrigerators
Medical Storage Cabinets
Dry Ice for Trailer Routes
Ice Cream Trucks

HEAT INSULATION

Insulation of Steam Traced Lines
Piping of Hot Viscous Fluids
Steel Mill By-Products
Central Station Steam
Cork as A Heat Insulation
Should Hot Flanges Be Insulated
Insulating Dual Purpose Lines

INSULATING REFRACTORIES

Designs for Home Pottery Kilns
Enamelling Furnaces for Lustron Homes
Soaking Pit Dampers
Controlled Atmosphere Furnaces

CONSTRUCTION AND MAINTENANCE

Converting Coolers to Freezers
Refrigeration Losses Through Freezer Doors
Floor Drain Constructions
Temporary Erection of Insulation
Cold Room Tracking
Right and Wrong Insulated Construction
Ventilation under Freezers

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2800° Fahrenheit

DAVIS FLOAT BOXES

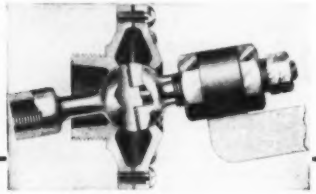
Davis No. 164D "Packless" Float Box with explosion proof switch.

FOR LIQUID LEVEL CONTROL SERVICE

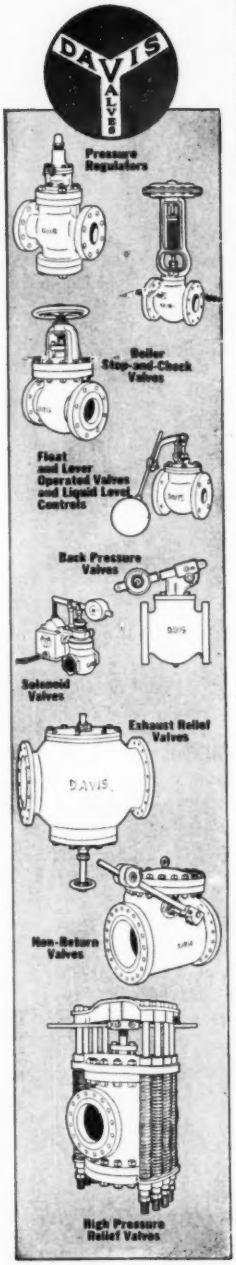
DAVIS Float Boxes are used in connection with closed tanks where fluctuation of the fluid level within the tank is the governing factor in the control of all types of electrical switches, control valves, pilot valves (for operation of diaphragm motor valves), motors and other equipment. Davis fluid control equipment also includes internal float units for direct or pilot operation. Whatever your requirement may be, Davis can supply you with a combination of float box and control valve to make your control accurate, positive, and dependable.

Drop us a card today for detailed information on the Davis line. Ask for Bulletin 101AA.

DAVIS DIA-BALL TRANSMISSION UNIT



A patented, leakproof, corrosion resistant packless assembly eliminating the packing box on Davis Float Boxes and Control Valves. Especially recommended for vacuum service or for use with volatile and inflammable fluids where a packing box is objectionable because of leakage. For pressures up to 250 lbs. and temperature up to 300° F.



DAVIS REGULATOR CO.

Representatives in All Principal Cities

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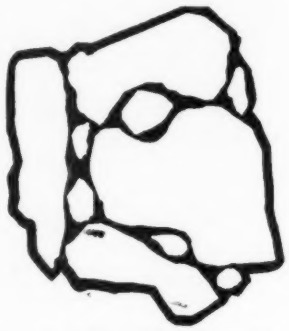
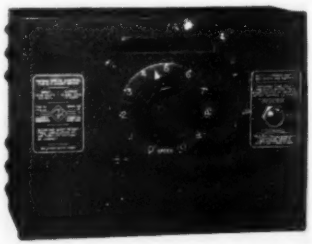
stop in case of belt failure, interchangeable parts through a wide range of sizes, ready adaptability to old or new steam engines of either horizontal or vertical design.
Troy Engine & Machine Co, Troy, Pa.



P997 • PLASTIC REFRACTORY—Dry, premixed plastic refractory, known as *DPM*, needs only water to be ready for application. It can be stored indefinitely. *DPM* comes in the same three grades as regular plastic refractory handled by this manufacturer.
Ramtite Co, 2549 W 18th St, Chicago 8, Ill.

P998 • CUTTING PLIERS—New line of diagonal cutting pliers are in 6- and 7-in sizes. Jaws are double hardened by electronically controlled heat treatment.
J H Williams & Co, Buffalo 7, N. Y.



P999 • MOTOR SPEED CONTROL—A simple, low-power, compact, single-unit speed control operates a 1/3-hp dc shunt motor from an ac line. Constant field voltage is supplied by a dry-disk rectifier. Armature voltage and speed are varied by an autotransformer feeding an electronic rectifier.

Smooth control is obtained from motor-rated speed down to practically zero. A single box houses both control and manual start-stop-reverse switch. Dynamic braking is provided in the stop position. Field

(*Continued on page* 184)

Bulletin on SUPER REFRACTORIES

by CARBORUNDUM
TRADE MARK

NO. 4 SEPTEMBER, 1949

How To Use Super Refractories

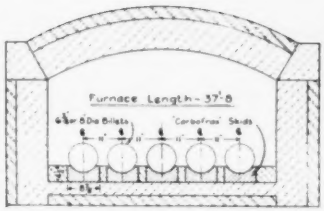
In most installations, there is at least one area where refractory life is curtailed by unusual conditions. Perhaps only a few brick—a tile or two—may be involved. Nevertheless, their replacement means furnace shutdowns . . . production delays . . . increased maintenance. In such cases, Super Refractories by Carborundum can prove to be profitable. They are better fitted inherently to withstand rigorous service. Specialized characteristics enable them to lick localized trouble spots. Improved overall refractories performance eliminates frequent, expensive outages. Definite savings result from the wise, even though limited, use of these super refractories with other less costly refractories.

More extensive use of Super Refractories by Carborundum may be indicated for some jobs. Possibly top performance will be insured only through their full utility. Numerous accepted processes, involving large scale usage, are practical and economical simply because of the well-considered application of these products.

Super Refractories by Carborundum are produced from several different basic materials. Each type is available in many varieties to better meet a wide range of service requirements. For best utilization, it is important to consult with our refractories engineers. Their recommendations are based on broad experience.

Physical Properties of Super Refractories by CARBORUNDUM
TRADE MARK

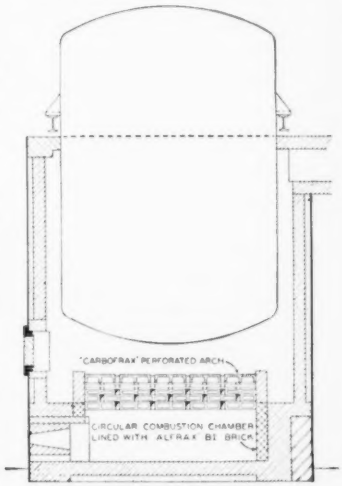
	CARBOFRAX	MULLFRAX	MULLFRAX S	ALFRAX K	ALFRAX B	ALFRAX BI
Heat Conductivity at 2200°F. in BTU/hr. sq. ft. and °F. /in. of thickness	109 BTU	16 BTU	9 BTU	24 BTU	12 BTU	7 BTU
REFRACTORINESS PCE CONE	37-40	38-39	37-38	37-39	39-40	38-39
SPALLING RESISTANCE	High	High	High	Good	Good	Good
ABRASION RESISTANCE	High	Medium	Medium	High	Medium	Low
THERMAL EXPANSION (25°—1400° C.)	.0000044	.0000059	.0000069	.0000074	.0000086	.0000086
MODULUS OF RUPTURE @ 2460° F. PSI	800-3125	100-250	175-475	100-1050	100-225	50-100
WEIGHT 9 IN. STRAIGHT	9.25 lbs.	9 lbs.	8 lbs.	10.1 lbs.	7.25 lbs.	4.8 lbs.



CARBOFRAX Skid Rail Life Increased From Weeks To Years

This extrusion-mill furnace is now equipped with CARBOFRAX silicon carbide skid rails. Formerly, a chrome hearth was used in the hot zone and alloy rails in cooler sections. This chrome-alloy combination required expensive maintenance and replacement every 2 to 5 weeks. In addition, pile-ups and wrecks were caused by rail warpage.

With the installation of CARBOFRAX skid rails, 3 years life is obtained before replacement is necessary. Frequent furnace outages are eliminated. Production is increased. Operating costs have dropped. Rails remain true—without warpage. There are no wrecks or pile-ups. Because frictional resistance is greatly reduced, brass billets are slid through the furnace more easily.



Set Kettle Utilizes Job-Fitted Super Refractories

Here is a case where judicious use of two different refractory materials resulted in extended service life of both the set kettle and setting. In addition, simplified and accurate temperature

"Carborundum," "Carbofrax," "Mullfrax," "Silfrax," "Alfrax" are registered trademarks which indicate manufacture by The Carborundum Company

Address all correspondence to: Dept. K-99. THE CARBORUNDUM COMPANY, Refractories Division, Perth Amboy, New Jersey

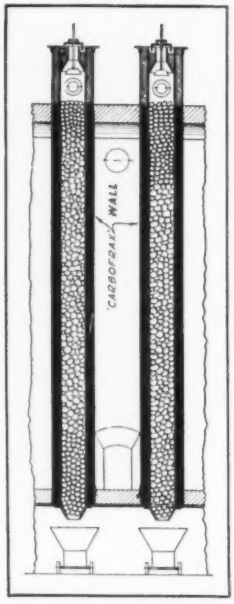
Continued on other side ➞

← Continued from other side

control has been achieved along with lower fuel costs.

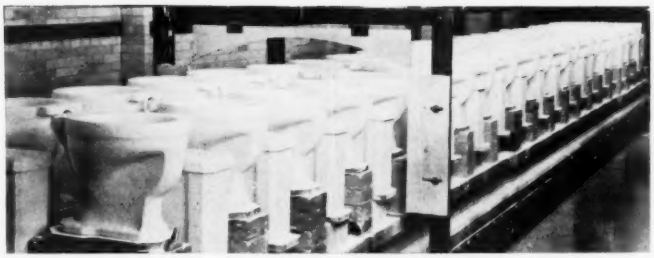
Because of their high mechanical strength and thermal conductivity, CARBOFRAX silicon carbide shapes were selected for the arch. More rapid and even radiation of heat to the kettle is provided. Lower temperatures are required in the combustion chamber. Moreover, remarkable resistance to spalling and cracking provides "insurance" against service interruptions.

Light-weight ALFRAX BI fused alumina insulating brick, applied to the combustion chamber to reduce heat storage in the setting, provides more accurate temperature control.



CARBOFRAX Vertical Retorts Open Door to New Processes

Several newly developed chemical and metallurgical processes are now not only possible but also economical through the use of CARBOFRAX refractories as the structural material for forming retorts. Restricting limitations that existed formerly are removed. Because of their high thermal conductivity, only moderate thermal gradients are required to transmit heat rapidly through retort walls. Close temperature control is provided. Consequently, combustion chamber temperatures are lower, fuel efficiency is improved, and refractory difficulties are minimized. Great strength at high temperatures plus mechanical and flame abrasion add long uninterrupted service to the other advantages of a CARBOFRAX vertical retort.



Operator Summarizes Advantages of CARBOFRAX Setters

Several important advantages of using CARBOFRAX setters are concisely summarized in this report from a producer of sanitary ware:

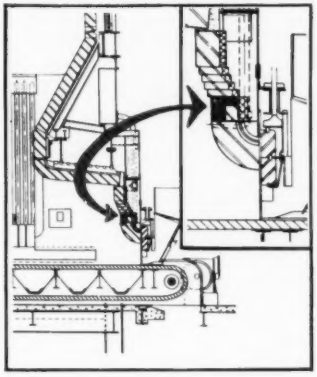
"Since going into operation (over 6 mos.) there have been absolutely no losses in tank or bowl setters due to firing cracks. All losses have been due to mechanical handling or dropping. There has been no sagging, warping, deformation or growth in size although the setters are supported only on the ends by firebrick and have no continuous support underneath."

Operating data: Firing Temperature—Cone 11. Cycle—33½ to 36 hours.

Judicious Use of Super Refractories Licks a Trouble Spot

Three courses of CARBOFRAX silicon carbide brick were all that were required to solve the troublesome problem of uneven secondary air distribution in this boiler furnace.

The trouble was traced to fingers of slag which formed above the air nozzles in the front and rear walls. This slag deflected the air streams enough to disturb secondary air distribution. Fuel burned unevenly. Shut-downs were frequent and fuel efficiency was lowered. When CARBOFRAX brick were installed just above the air jets, the trouble was eliminated. Slag can not anchor on the smooth, hard, dense surface of this clinker-resistant Super Refractory.



This Flue-Connector Lining Has Seen 10,000 Hours of Service

There is a distinct lack of carbon build-up in this unretouched photo of a flue connector lining after 10,000 hours of service. The hard, dense, smooth surface of CARBOFRAX lining provides no anchorage for these obstructions. Equally important is the freedom from erosion despite the fact that the lining has been subjected to the beating of millions of abrasives particles travelling at terrific velocity. Cleaning is minimized, down-time for repairs is reduced.

A complete file of informative literature covering super refractories is available through The Carborundum Company. There are facts and figures on installations in specific fields. To obtain copies of reports, booklets and catalogs of particular interest is a simple matter. Merely select from the list printed here. Copies will be sent you at once. No obligation, of course.

- Super Refractories by CARBORUNDUM (general catalog)
- Super Refractories for the Ceramic Industry
- Super Refractories for the Process Industry
- Super Refractories for Boiler Furnaces
- Super Refractories for Heat Treatment Furnaces
- Super Refractories for Gas Generators
- The FRAX Line of Cements
- CARBOFRAX Refractory Skid Rails
- Bulletins Nos. 1, 2, 3 on Underdrain Systems and Diffuser Media

Dept. No. K-99

THE CARBORUNDUM COMPANY
Refractories Division
PERTH AMBOY, NEW JERSEY

SPECIAL RESILIENT CORE
INNER BRAID SECURED TO RESILIENT CORE
OUTER SQUARE PLAITED BRAID SECURED TO INNER BRAID
The Anchor Packing Co.

IN THIS FLAX PACKING *you get* STRENGTH AND DURABILITY

THE ANCHOR PACKING CO.

ANKORITE 387-F

Furnished in coil or ring form or on reels... for high or low pressures... temperatures to 200°F... size ⅜" square to 1½" square.

Examine the special construction of Ankorite 387-F as shown in cross-cut sectional view. You will see how the resilient core is bonded to the inner braids with a binder which makes the interior impervious to liquid pressures. This permits the soft outer braids to absorb a portion of the liquid and keep it in contact with the plunger or shaft surface, thus insuring liquid film lubrication at all times. Soft lead wires interspersed only in the outer braid, are sufficient to promote low friction contact and protect shaft or plunger surface.

SUGGESTED USES: Circulating Pumps... High Pressure Hydraulic Apparatus... Hydro-Turbine Shafts... Water Works Pumps... Ship Propeller Shafts... Ship Rudder Post... and wherever else Flax Packings are used. Write today for full details.

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THE ANCHOR PACKING COMPANY

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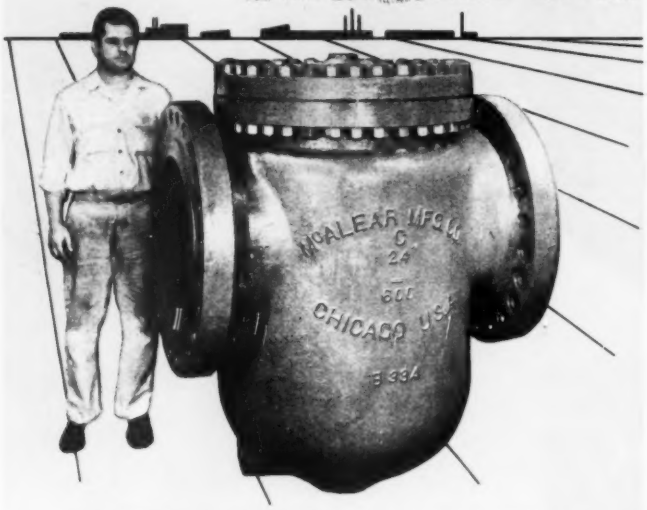
McALEAR
STRAINERS

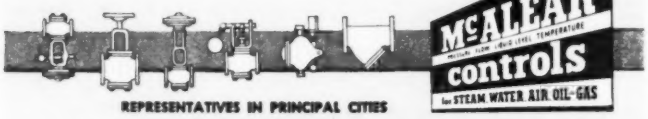


ANY SIZE ANY PURPOSE ANY MATERIAL

If your piping plan calls for strainers, consider the McAlear line. It ranges in size from ½" to 24" and includes all types . . . flanged or screwed bodies . . . clamped or bolted covers . . . bodies and baskets of steel or virtually any special alloys . . . pressure ratings for all services. The strainer above, for example, is one of several shipped for hydraulic service. Body, cast steel. Basket, stainless steel. Size, 24". Weight, 10,000 pounds.

Write today for Bulletin No. 128 describing the standard McAlear line. Or tell us your requirements for *any* type of strainer.

McALEAR Mfg. Co.
1901 SOUTH WESTERN AVENUE
CHICAGO 8, ILLINOIS



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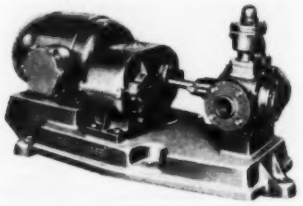
AN INDEPENDENT MANUFACTURER FOR OVER 40 YEARS

voltage can be adjusted in steps to change maximum speed. Both 115- and 230-v models are available.
General Radio Co, 275 Massachusetts Ave, Cambridge 39, Mass.

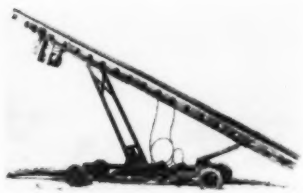


P957 • SLIDING-VANE PUMP — Viscous liquids up to 100,000 ssu can be handled with this sliding-vane rotary pump, the vanes of which are positively actuated by push rods through rotor and shaft.

Sliding vanes can be furnished in a sound-deadening, nonmetallic material in most instances. They are relatively more quiet and wear resistant than conventional metal vanes. Vanes are self-adjusting for wear and are replaceable without disturbing piping or drive.
Blackmer Pump Co, Grand Rapids, Mich.

P916 • ENCLOSED MOTOR—Totally enclosed, fan-cooled squirrel-cage motor has copper fins embedded in stator laminations for additional cooling. Type *CS* motors are designed for dust-laden atmospheres.

Motors are available in ratings up to about 1500 hp at 1800 rpm, Class B insulation. 75-C rise; other electrical characteristics are similar to those in standard open, squirrel-cage induction motors.
Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa.



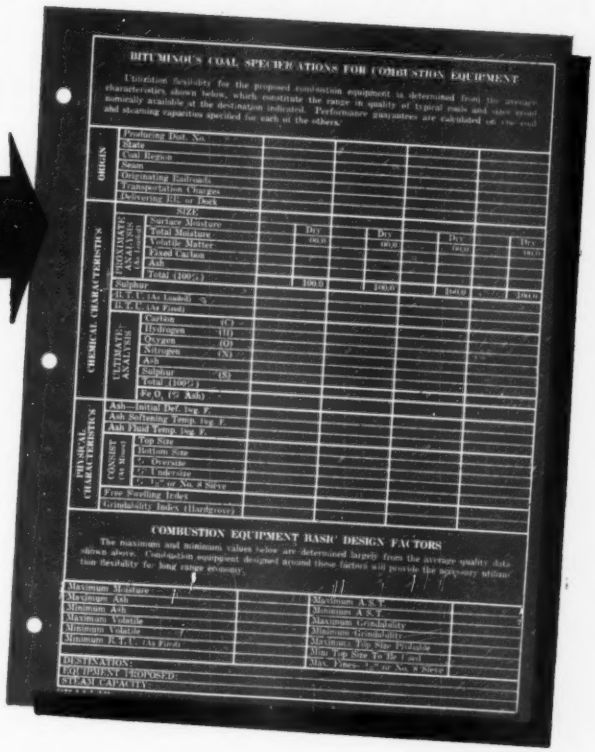
P903 • PORTABLE CONVEYOR — Lightweight, portable, belt conveyor has hydraulically controlled belt and is mounted on a new hydraulically controlled lift frame. It has a hydraulic system powered with either an electric motor or gasoline engine.

Hydraulic control permits reversing of the belt and a range of speeds from 0 to 400 ft per min. It is available as a bulk or package conveyor. The hydraulically controlled lift frame, mounted on four wheels with pneumatic tires, permits a wide variety of positions for the conveyor. Height of its low end can be adjusted from 20 to 48 in. and of the high end, from 4

FUEL FLEXIBILITY *helps cut costs*

Fuel flexibility means built-in capacity of fuel burning equipment to utilize the best fuel value available.

Here's Your First Blue Print...



BITUMINOUS COAL SPECIFICATIONS FOR COMBUSTION EQUIPMENT

Utilization flexibility for the proposed combustion equipment is determined from the average characteristics shown below, which substitute the range in quality of typical coals and sizes normally available at the destination indicated. Performance guarantees are calculated on the coal and cleaning capacities specified for each of the others.

ORIGIN: Producing Dist. No. · State · Coal Region · Seam · Originating Railroads · Transportation Charges · Delivering RR. or Dock

SIZE

CHEMICAL CHARACTERISTICS

PROXIMATE ANALYSIS: Surface Moisture · Total Moisture · Volatile Matter · Fixed Carbon · Ash · Total (100%) · Sulphur · B.T.U. As Loaded · B.T.U. As Fired

ULTIMATE ANALYSIS: Carbon (C) · Hydrogen (H) · Oxygen (O) · Nitrogen (N) · Ash · Sulphur (S) · Total (100%) · Fe$_2$O$_3$ (% Ash)

PHYSICAL CHARACTERISTICS: Ash—Initial Def. Eng. F. · Ash Softening Temp. Eng. F. · Ash Fluid Temp. Eng. F.

SIZE CONSIST: Top Size · Bottom Size · % Oversize · % Undersize · % 3/8" or No. 4 Sieve · Free Swelling Index · Grindability Index (Hardgrove)

COMBUSTION EQUIPMENT BASIC DESIGN FACTORS

The maximum and minimum values below are determined largely from the average quality data shown above. Combustion equipment designed around these factors will provide the necessary utilization flexibility for long range economy.

Maximum Moisture · Maximum Ash · Minimum Ash · Maximum Volatile · Minimum Volatile · Minimum A.S.T. (As Fired) · Maximum A.S.T. · Minimum A.S.T. · Maximum Grindability · Minimum Grindability · Minimum Top Size Probable · Max. Top Size To Be Used · Max. Fines—3/8" or No. 4 Sieve

DESTINATION: · EQUIPMENT PROPOSED: · STEAM CAPACITY:

Correct fuel design tolerances and good engineering provide:

1. Ample furnace volume
2. Necessary water-cooled furnace surface to bring furnace exit temperature below ash softening temperature of the coal offering the lowest heat unit cost on a long-range basis.
3. For stoker-firing — adequate grate area to assure a combustion rate below 500,000 Btu per sq.ft. at maximum continuous loads.
4. For pulverized-coal firing — sufficient capacity to handle 50 (Hardgrove Scale) grindability coal at full load, with minimum maintenance and power consumption.
5. Efficient mechanical coal and ash handling equipment.

COMBUSTION EQUIPMENT BASIC DESIGN FACTORS

The maximum and minimum values below are determined largely from the average quality data shown in the above form. Combustion equipment designed around these factors will provide the necessary utilization flexibility for long range economy.

Maximum Moisture	10.0%	Minimum A.S.T.	2000F.
Maximum Volatile	38.0%	Min. Grindability	50
Maximum Ash	12.0%	Max. Top Size Probable	2"
Maximum Sulfur	3.5%	Min. Top Size to be used	½"
Min. B.T.U. (As Fired)	12,200	Max. Fines Under ⅛"	75%

FAIRMONT PITTSBURGH SEAM COAL assures the lowest over-all steam cost for the life of the steam generating plant. Proved reserves will still be adequate in 2050 A.D.

FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

Kindly place my name on your mailing list to receive copies of your publications and Technical Reference Bulletins.

NAME ..... COMPANY .....

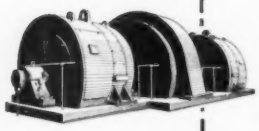
POSITION ..... Nature of Business .....

STREET ADDRESS ..... CITY ..... ZONE ..... STATE P949

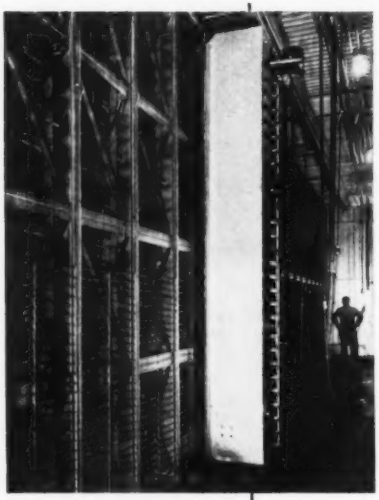
FAIRMONT COAL BUREAU · FAIRMONT REGION · WEST VIRGINIA · SERVICE TO INDUSTRY

Where SUPER-CLEAN AIR for mill motors is a "must"

AAF Electro-Cell combines high cleaning efficiency with ease of maintenance



WHERE conditions permit no compromise in the cleanliness of the air supplied for cooling mill motors, the AAF Electro-Cell is your logical choice. This electronic precipitator gives positive protection against dust and smoke—even down to fractional micron sizes.



An Electro-Cell Precipitator of 216,000 CFM capacity with AAF automatic washers now in its third year of service

Removable collector plate cells permit selection of maintenance method best suited to your operation. Cells may be manually washed and re-oiled in place; removed for easy cleaning in a special tank, or washed, dried and recoated automatically (as illustrated) with minimum interruption to operation.

Electro-Cell's sectional construction reduces weight of parts, eliminates multiplicity of electrical connections, protects wiring from dirt and water. And its full-height hinged or removable ionizers minimize electrical losses, reduce ozone and simplify replacement of ionizing wires.

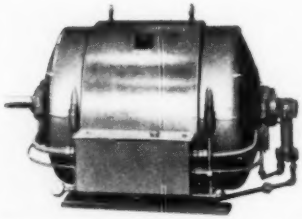
If you want super-clean air plus proven savings in operation and maintenance, get complete Electro-Cell data now. Just contact your local AAF representative or write direct for Bulletin No. 252.

AMERICAN AIR FILTER COMPANY, INC.
201 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF

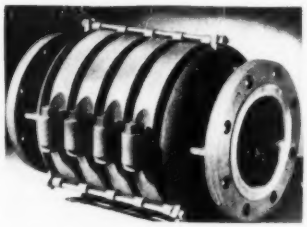
AIR FILTERS
AND DUST CONTROL EQUIPMENT

to 15 ft, depending on conveyor length. Standard conveyors are available in lengths from 10 ft up in multiples of 2 ft, with belt widths of 8, 10 and 16 in.
Lake Shore Engrg Co, Iron Mountain, Mich.



P951 • FEEDWATER PUMP MOTOR—Two-pole 3600-rpm squirrel-cage induction motor has dripproof construction with pressure-lubricated bearings. Available up to 1250 hp, motor is suitable for service with boiler feedwater pumps in power plants.

Oil pump is worm-geared to motor shaft, drawing oil from reservoir at motor's side, and pumping it into the two bearings. High-pressure side is also bypassed to the oil reservoir.
Electric Machinery Mfg Co, Minneapolis 13, Minn.



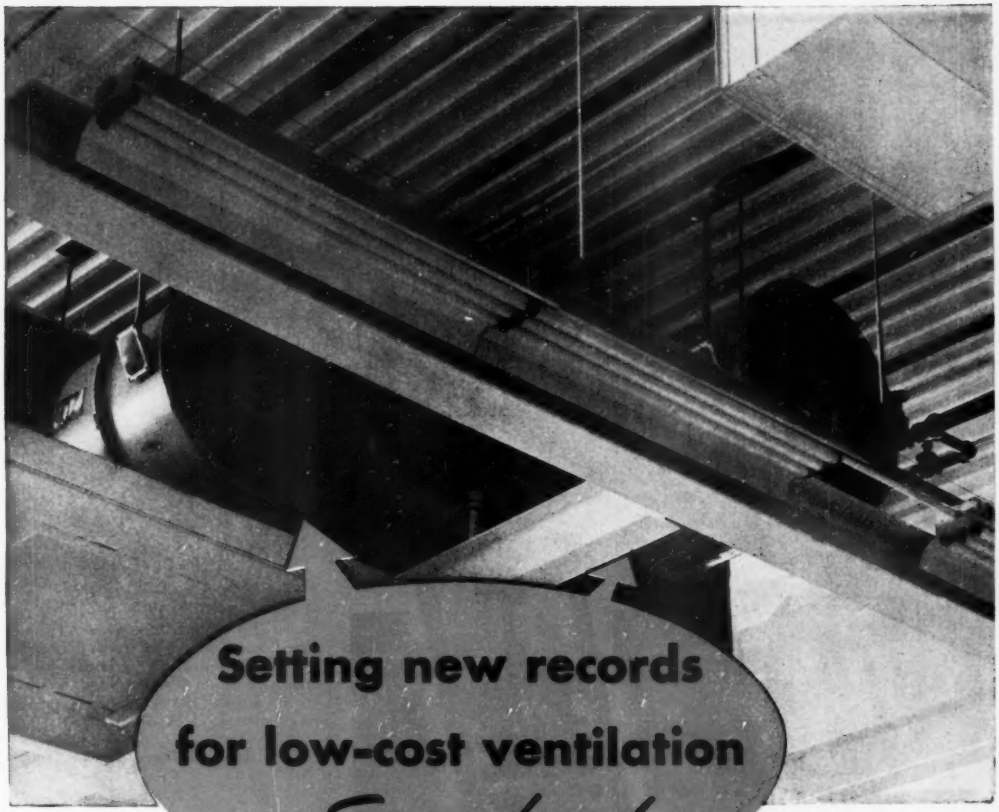
P921 • EXPANSION JOINT—*Corruflex* expansion joint requires no packing and is suited for service in remote and difficult-to-service locations. Compactness permits using the joint in trenches, tunnels or other cramped quarters.

Joint is available in sizes from 3 to 24 in., single or multiple corrugation, with or without self-equalizing rings, single or double units and with either flanged or welding end. It is supplied in copper, stainless steel or other alloys and with internal sleeves if required.

Traverse of the joint ranges from fractions of an inch to 15 in., and will operate under pressures from vacuum to 300 psi and temperatures from sub-zero to 1600 F.
American District Steam Co, North Tonawanda, N. Y.

P917 • PRESSURE TANK MEASUREMENT—Fast, accurate determination of best high water level under all operating conditions for hydro-pneumatic tanks can be had with the Autocon hydro pneumatic tank calculator.

The calculator, 9 by 4 in., is based on Boyle's law. It tells: (1) best air-water ratio (2) most efficient pressure differen-



Setting new records for low-cost ventilation *Everywhere!*

JOY AXIVANE* FANS

WITH JOY AXIVANE Fans, you profit by the greater efficiency, quieter and smoother operation, and lower power consumption of their vaneaxial design. You save on installation, too. These light, compact, in-line fans mount directly in the air duct—saving space and time, making foundations, guards, etc. unnecessary. What's more, the *exclusive* adjustable-blade feature of JOY Fans gives you extra flexibility—permits easy adjustment on the job to suit new conditions or compensate for faulty duct work. ● Let us show you how to get *best* ventilating results!

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Consult a Joy Engineer

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You can count on Masoneilan "500 Series" reducing valves and pump pressure regulators for accurate control of steam pressures. Their proved-performance records in scores of industrial applications assure savings for you, too. Calibrated springs and ball bearing stem guides insure accurate responsive control. Available in sizes from ½" to 6"; maximum working pressures from 125 lbs. at 350°F., to 250 lbs. at 450°F.; pressure ranges ¾-3; 2-8; 6-25; 20-75; 60-160 lbs. Write for information.

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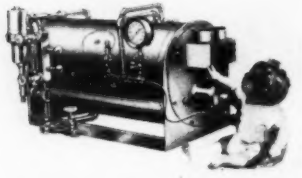
tial (3) exact amount withdrawn on any pressure drop (4) resultant reserve or residual. This information can save power and reduce maintenance costs by anticipating pump operations per hr at any demand rate. All computing scales are on one side of the calculator and simple instructions are included.

Automatic Control Co, 1005 University Ave, St Paul 4, Minn.

P927 • OIL FILTER—*Hiltex* filtering material is a clean, high-grade cotton with fine Sequoia bark fibers, making a material of uniform density that is easily handled and packed into filter cartridges. It comes in 2½-lb batts. *Hiltex* is suitable for filtering mineral, heavy-duty, additive and detergent-type oils.

Hiltex Dept, Hilliard Corp, Elmira, N. Y.



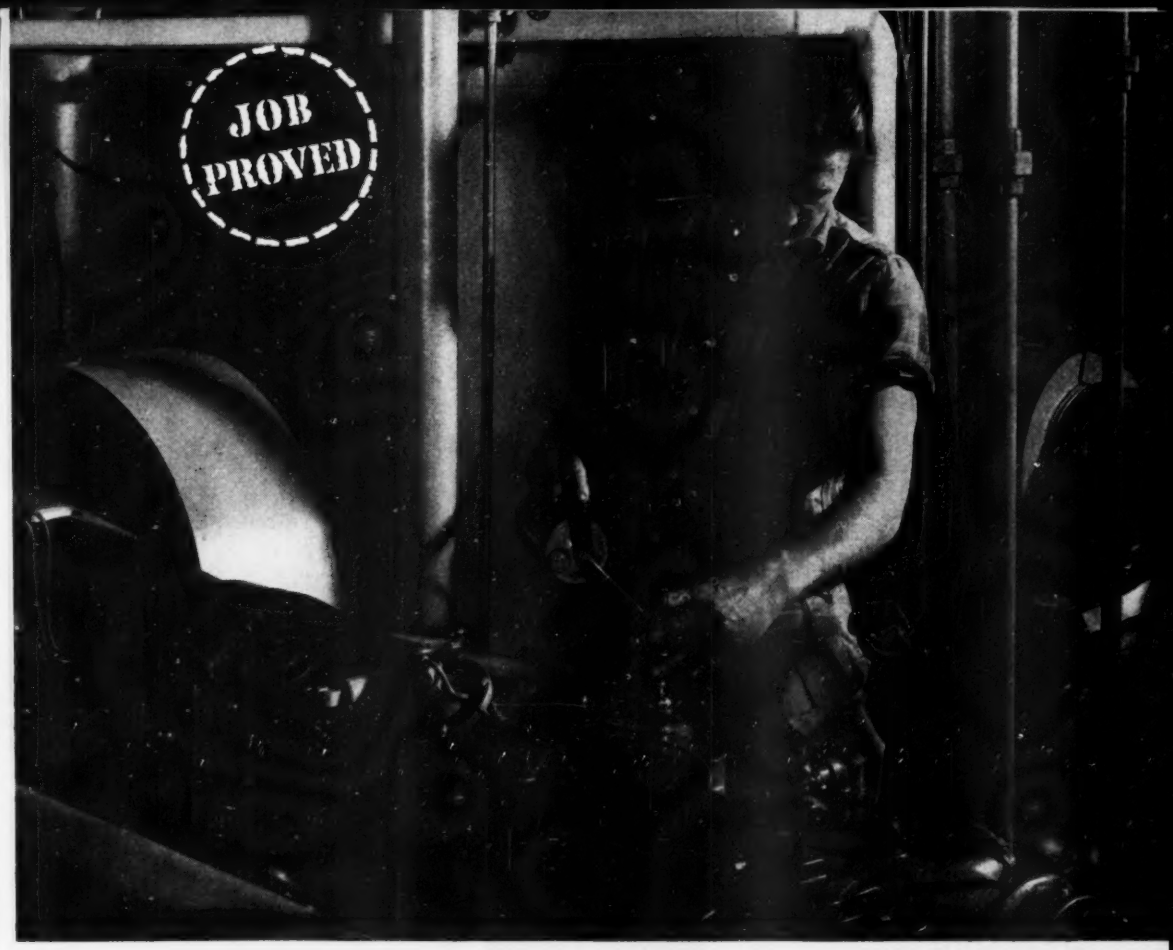
P902 • SCOTCH MARINE BOILERS—Miniature *Scotch* marine type boilers, the *Little Scotchman* series, available in 105, 175, 245 and 350 lb per hr steaming capacities, develop up to 100 psi.

All-steel construction, fully-lagged, steel-jacketed boilers come as a complete package ready to hook up to fuel and water lines. The model burns gas or oil. The smallest one, the 105 lb per hr unit, measures slightly over 4-ft long by 2 ft wide by a little under 2 ft high.

Steamaster Automatic Boiler Co, 5819 Compton Ave, Los Angeles , Calif.

P905 • ARC WELDING MACHINE—Portable, economical ac transformer arc welding machine has a rated output of 200 amp and is built especially for small shops.

Wilson 200 amp is completely self-contained; has its welding range divided into two current adjustments with stepless



UNDER PRESSURE 11 YEARS...STILL GOING STRONG

A Sun Oil Helps Keep Compressor on the Job 16 Hours a Day—No Hard Carbon Forms

The "lungs" of a forced ventilation system in a large industrial plant are two-stage air compressors—pumping air through the system at 300 pounds per square inch.

One of these compressors, now over 11 years old, has been running 16 hours a day since its installation. From the start, a Sun lubricant has been used to lubricate crosshead and air cylinder. During the past five years there has been but one shutdown . . . and that occurred when a different brand of oil was used by mistake!

Operating on the Sun lubricant, the compressor is running as well today as ever. No hard carbon has formed. As a result of this record the plant has standardized on Sun lubricants for all its air compressors and vacuum pumps.

This performance is typical of the advantages gained from "Job Proved" Sun lubricants in thousands of industrial plants. Further information can be had from any Sun Office. For a copy of the booklet "Lubrication of Air Compressors and Pneumatic Tools" write Department PM-9.

SUN OIL COMPANY • *Philadelphia 3, Pa.*
In Canada: Sun Oil Company, Ltd.
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SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

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OPERATIONS IMPROVED • STEAM COST REDUCED

● Stickle Equipment increases the efficiency of industrial processing operations, and reduces the overall cost of steam.

Stickle Valves supply accurate regulation of steam to meet minute-by-minute requirements of production. Stickle Traps keep production units free of condensate and air to maintain maximum production effectiveness. Stickle Differential Drainage and Boiler Return Systems save fuel by returning condensate to boilers, under pressure, with little loss of heat units. Stickle Open Coil Feed Water Heaters preheat raw makeup water with exhaust steam, otherwise wasted, and purify the boiler supply by eliminating scale-forming substances and oxygen.

Whether as individual units or in complete systems, Stickle Equipment is available in design for specific operating conditions and in capacity to fulfill operating requirements. Stickle Equipment is simple in construction, positive in operation, and dependable in service.

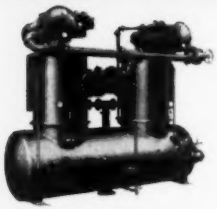
ASK FOR BULLETINS

The following bulletins supply mechanical information and engineering data on various items and lines of Stickle Steam Specialties: *Bulletin No. 117*—Stickle Open Coil Feed Water Heaters and Purifiers. *Bulletin No. 250*—Stickle Differential Drainage and Boiler Return Systems. *Bulletins No. 235 and No. 435*—Stickle Regulating and Reducing Valves. *Bulletin No. 501*—Stickle Temperature Control Valves. *Bulletins No. 115, No. 315, No. 415 and No. 515*—Stickle Open Float Steam Traps (state application for trap desired). *Bulletin No. 200*—Stickle Oil and Steam Separators.

STICKLE STEAM SPECIALTIES COMPANY
2265 Valley Avenue, INDIANAPOLIS 18, INDIANA

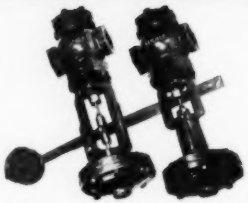
STICKLE DRAINAGE AND CONTROL EQUIPMENT

STICKLE OPEN COIL FEED WATER HEATERS



● Large heating capacity for given space. Deaerating and non-deaerating types. Cast iron or steel construction. Capacities from 3,000-lb. single heaters to 250,000-lb. dual heaters.

STICKLE REGULATING and REDUCING VALVES

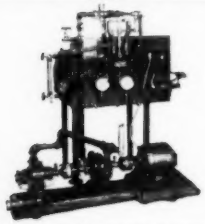


● Single-seated, balanced and Double-seated, semi-balanced self-contained valves. Semi-balanced pilot-operated valves. Standard and pilot-operated back pressure valves. Float valves. Desired sizes.

STICKLE OPEN FLOAT STEAM TRAPS

● Natural, positive action. Trouble-free operation—no friction, no sticking, no levers or hinges to get out of order. A-design and size for practically any industrial application.

STICKLE DIFFERENTIAL DRAINAGE and BOILER RETURN SYSTEM

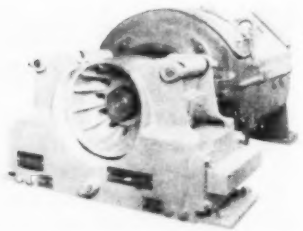


● A closed pumping system for returning condensate directly to boilers from processing units operating at high pressure. Saves fuel. Increases boiler capacity. Reduces pumping costs. Decreases maintenance on pumps, traps and valves.

control within each adjustment, secondary circuit capacitors for easy arc starting and stability; built-in primary circuit capacities for power factor correction.
Air Reduction Sales Co, 60 E 42nd St, New York 17, N.Y.

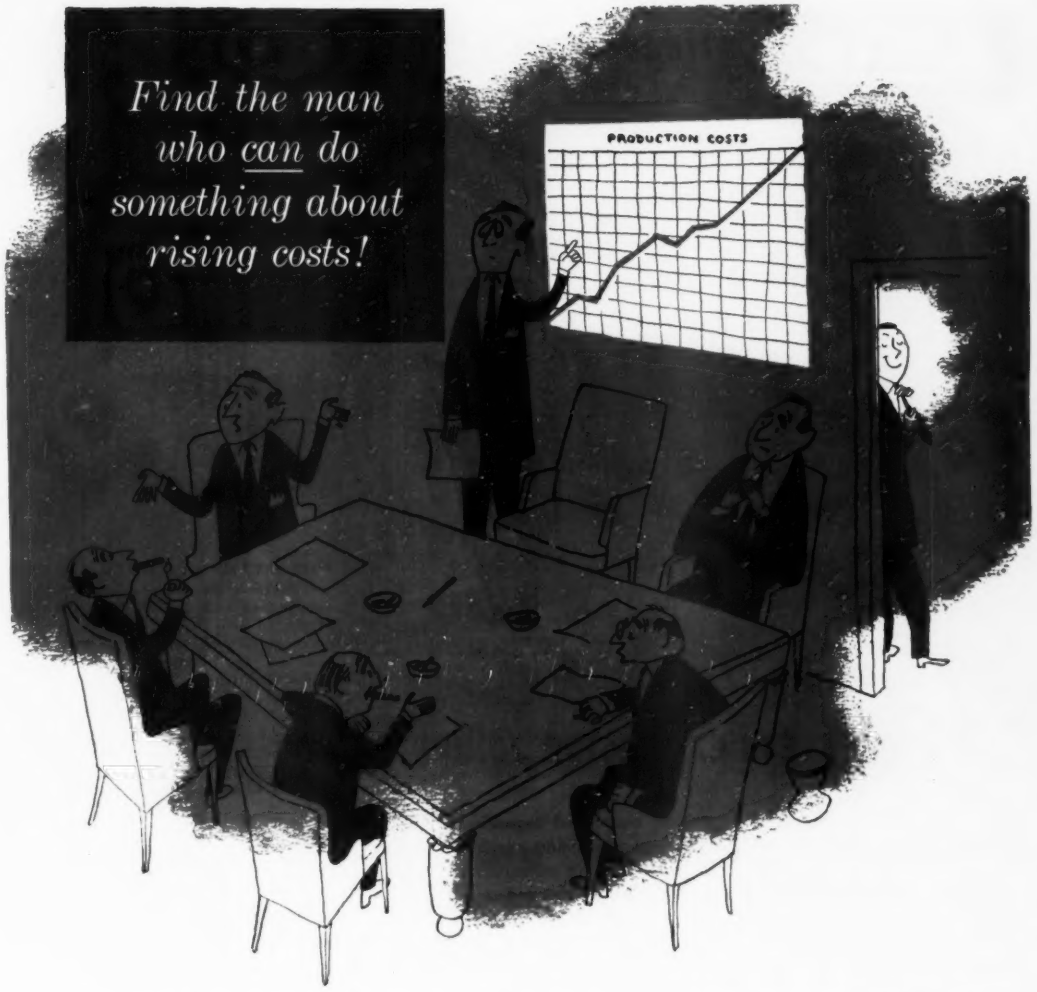
P929 • FIRE EXTINGUISHER—Dry chemical unit is free flowing and has no syphon tubes or valves within cylinder to become clogged or inoperative. Discharge hose and nozzle remain empty until fire extinguisher is actuated. It comes in 20 and 30 lb capacity.

Chemical is non-conducting, non-corrosive, non-freezing, and non-toxic. It is effective on flammable liquid and electrical fires. Dry chemical for recharging comes in 20 and 30-lb sizes as well as in 50-lb bulk sizes. It carries Underwriters' Laboratories approval. Rating is B-1, C-1.
C-O-Two Fire Equipment Co, Newark 1, N. J.



P946 • TWO-MAGNET BRAKE—De 2-shoe, 2-magnet brake is designed for service on steel-mill drives, cranes, hoists, bridges, conveyors, and for general marine service. The brake consists of a malleable-iron frame, two self-aligning shoes that pivot on spherical bearings, two armatures pivoting on sealed graphite bearings, two symmetrical E-type magnets with cast-in coils, and a ventilated wheel of molybdenum alloy.

Iron frame protects all moving parts;



In most businesses, operating costs are still on the rise. But there's *one* man who *can* do something about it—he's the man whose job is to get maximum heat and power from fuel dollars. He knows you *get* maximum efficiency from Eagle-Picher Industrial Insulations because they're made of durable, chemically and physically stable *mineral wool*, noted for its low conductivity. They give long years of service and are easy to maintain and replace.

There's an Eagle-Picher insulation that can help reduce *your* operating expenses!

Let these Eagle-Picher products also save you money . . . power . . . time

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Since 1843

ADSCO introduces

ADSCO *Corruflex*

PACKLESS EXPANSION JOINTS.

Corruflex, ADSCO's new packless corrugated expansion joint, rounds out the most complete line of expansion joints available from any manufacturer. Only ADSCO can make both an expert analysis of your expansion problem *and* an impartial recommendation of the type of joint to use.

Corruflex, because it is packless, is ideally suited for remote and difficult-to-service installations.

Corruflex is economical because it makes expensive pipe bends unnecessary.

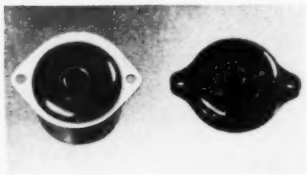
Corruflex is available in sizes from 3" to 24", single or double units, single or multiple corrugations, with or without self-equalizing rings and with flanged or welding ends. It is supplied in copper, stainless steel or other alloys and with internal sleeves if required.

Corruflex has a traverse range from fractions of an inch to 15" and will operate under pressures from vacuum to 300 lbs. and temperatures from sub-zero to 1600° F.

For further details, consult your ADSCO representative or write for Folder No. Z-149.

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.
SINCE 1877

universal ball joints, protected by neoprene sleeves, permit self-alignment of shoes, insure uniform lining wear, and a quick-release mechanism. Brake linings can be changed without disassembling any parts. The cast-in coils, sealed in a heat-resisting insulating compound, reduces "stick-in" because of residual magnetism, protects against moisture and has good heat transfer. The torque-setting indicator gives a direct reading of ft lb torque setting and the clearly marked operating gap indicator provides a ready visual check on magnet gap and lining wear. The brake is applicable for either right- or left-hand mounting, either on the floor or, with brackets, on motors.
General Electric Co, Schenectady 5, N.Y.



P948 • LAMP HOLDERS — Available in black or white, the new lamp holders may be used for *Slimline* fluorescent lamps of the *T6* and *T8* size. They require a minimum of mounting space and provide great flexibility in application.

The single-contact, high-voltage end has an internal spring mounting that allows easy insertion and removal of lamp. Spring action also insures positive electrical contact, along with safe and firm seating of lamp in sockets.
Sylvania Electric Products Inc, Salem, Mass.

P938 • GUSHER PUMP—Motor-driven pump has large multiple inlet cast into upper section of impeller housing, a vertical tubular housing between motor and impeller housing, and straight vertical discharge pipe. The standard pump is made of cast iron, but it can be made of stainless steel, bronze, aluminum, lead antimony alloy, with a shaft of cold-rolled or stainless steel. It is applicable for handling acids, alkalies and other liquids.

Driving motor is totally enclosed, drip proof and has a large conduit box and pre-

The PITTSTON COMPANY

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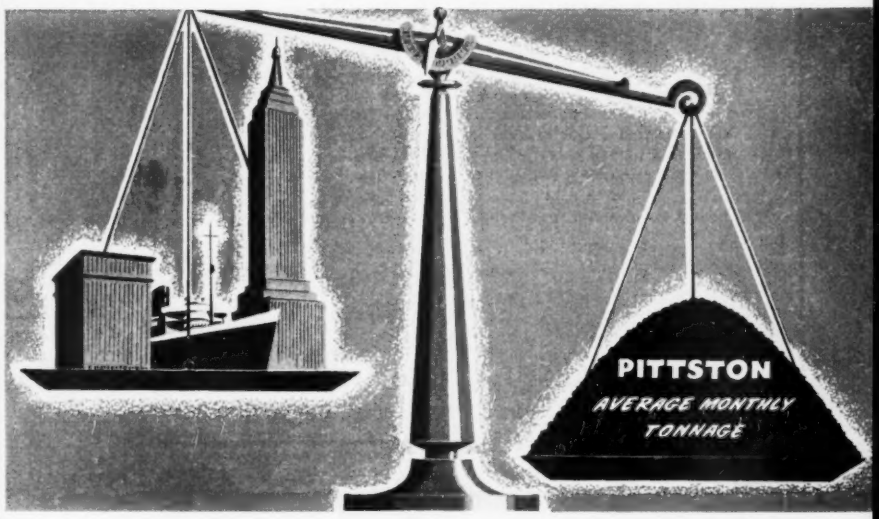
WEIGHTY FACTS!

The total weight of the average monthly tonnage of bituminous coal and anthracite sold by Pittston distributing companies is much greater than the combined weights of the Empire State Building, the Queen Mary and the McCormick Building in Chicago.



Why this big tonnage?...because—

- The Pittston Company is the parent organization of seven bituminous coal subsidiaries – producing quality bituminous coals for *all your needs.*
- Pittston has recently completed a $14,000,000 expansion and improvement program, making possible larger and better production.
- Pittston subsidiary mining plants have been equipped with the latest in mechanical mining and cleaning devices.
- Pittston subsidiaries own outright, or have long term leases on thousands of acres of the finest coal lands in the country...enough coal reserves for many years.
- Pittston subsidiaries mine and distribute versatile coals... Clinchfield medium volatile coal, Compass Fairmont steam coal, Lillybrook low volatile bituminous, Davis-Piedmont smithing coal, and other well known trade-marked and trade-named fuels They are in demand for many widely divergent uses ...for Retail Dealers, Public Utilities, Industrial Plants, By-Product Plants, Railroads, and for Stoker and Domestic use.
- Pittston makes available without charge a complete engineering service to help customers select the coal best suited to their needs.

Pittston's Sales Subsidiaries are always ready to serve customers' needs in all parts of the United States, South America and abroad.

The PACKING for LONG SERVICE

ALLPAX

ALLPAX is the packing that won't let you down when temperatures go up or when you are looking for long, care-free service from your equipment. One of the reasons for the long-wearing service of ALLPAX is that it remains perfectly dry while holding its lubricant regardless of pressure or temperature. Its long asbestos fibres prevent the molded ALLPAX from amalgamating into a dense metallic mass, but keep it bonded together in a resilient packing that retains its springiness even after long service. This resiliency makes ALLPAX leak-proof without excessive pressure. The lubricant in ALLPAX cannot be forced out regardless of pressure, and a perfect film is maintained between packing and shaft at all times.

Try ALLPAX and prove its advantages in long service.

ALLPAX distributors are all around you. Get in touch with yours and ask him to supply your requirements.

THE ALLPAX CO., INC.

MAMARONECK, NEW YORK

JUST PRINTED

Two bulletins showing how

NEW G-E MOTOR EXCHANGE PLAN

cuts machine down time

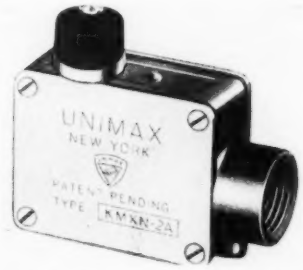
Get the story of the new time and money saving General Electric exchange plan for Tri-Clad integral-hp motors! It's an extension of the highly successful G-E fractional-hp motor exchange plan and covers most popular types of Tri-Clad open dripproof motors—one to five hp. Bulletin GEA-5189 is for motor users; Bulletin GEA-5180 is for machinery manufacturers. Write on your letterhead FOR FREE COPY: *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

Look for this extra on the motors you buy; it means lower maintenance costs, less time lost for motor replacement.

GENERAL ELECTRIC

726-3

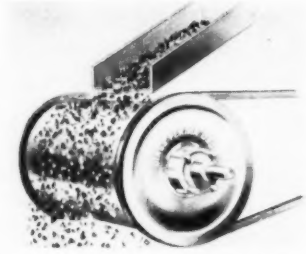
lubricated for life ball bearings. Explo-ion-proof motors can be obtained, built to Underwriters' Laboratories specifications. Class I, Group D. Capacities are 25 gpm at 15-ft head, 30 gpm at 13 ft, 40 gpm at 10 ft, using ¼-hp, 1725-rpm motor.
Ruthman Machinery Co, Cincinnati 2, Ohio.



P955 • SEALED-PLUNGER SWITCH—Entrance of moisture or dust to plunger mechanism of Model *KMXN-2A* switch is stopped by neoprene "boot" sealed to actuating plunger. Besides being oil resistant, the neoprene compound retains its flexibility at all temperatures from minus 65 to plus 160 F. Die-cast metal case has removable side plates, neoprene side gaskets, and threaded mounting studs.
W L Maxson Corp, 460 West 34th St, New York 1, N.Y.

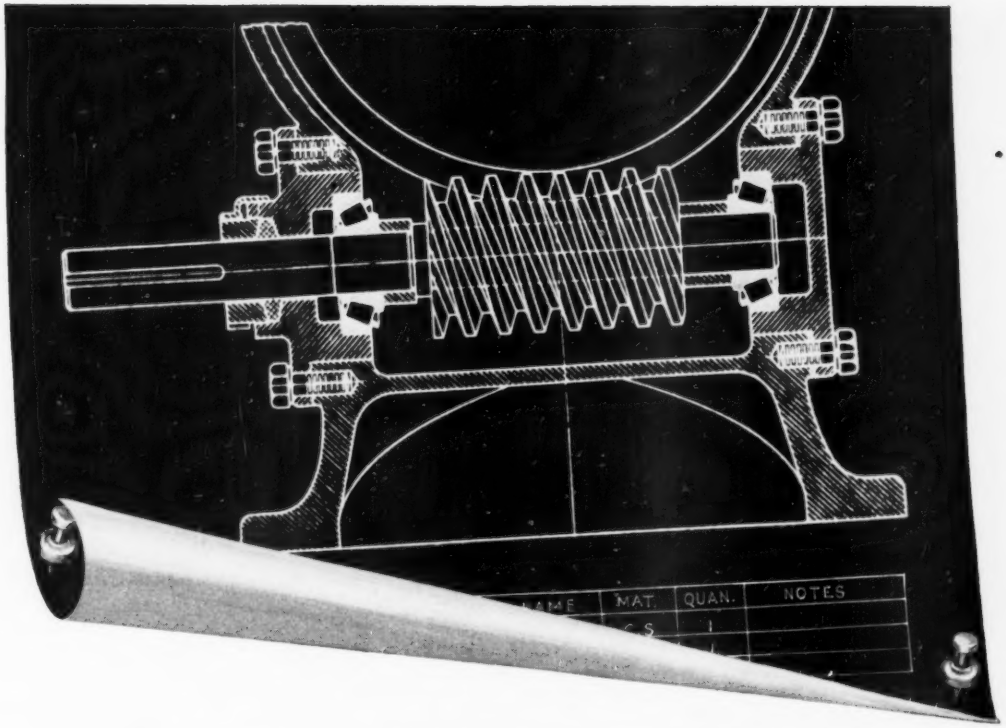
P930 • PACKING EXPANDER—*U* expander is made in strip form and designed so it will fit different diameters of hydraulic packing. It is made of specially rolled brass strip material. Expander is impervious to corrosion from brine solution, gasoline, sea water and other solutions.

Expander evenly supports packing and maintains uniform pressure on ram and inside wall of the recess by pressure it creates on side walls of *U* packing.
H P L Mfg Co, 2013 E 65th St, Cleveland 13, Ohio.



P935 • MAGNETIC SEPARATOR—Drum *alnico* permanent magnet separator, for V-belt drive, can be installed at the discharge of chutes, spouts and conveyors to remove tramp iron from feed, grain, rubber, glass, fertilizer, chemicals, plastics, tobacco, minerals, food, coal, sand, textiles, metals and powders.

Circumferential pole design gives uni-



How to make your product do more work with less play

YOUR product does its job more efficiently and lasts longer when every rotating shaft is mounted on Timken® tapered roller bearings.

Timken bearings hold shafts in true alignment, prevent shaft deflection and end-play, keep gears meshing smoothly. Due to their tapered construction, Timken tapered roller bearings take any combination of radial and thrust loads. Special thrust bearings or washers are unnecessary. Design can be simplified—space saved.

Timken bearings are manufactured to extreme precision. Their true rolling motion practically eliminates friction on moving parts. Line contact between the rolls and races provides maximum load-carrying capacity.

Made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel—Timken bearings last the life of the machine in which they are used.

No other bearing can bring you *all* the advantages you get with Timken bearings—backed by fifty years of research and development. Make them standard in all the machinery you buy or build. And look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

50th birthday of the company whose products you know by the trade-mark: TIMKEN

TIMKEN 1899 50 YEARS 1949

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL — NOT JUST A ROLLER — THE TIMKEN TAPERED ROLLER — BEARING TAKES RADIAL AND THRUST — LOADS OR ANY COMBINATION

Simplicity itself, the cotter, and certainly not costly . . . yet as indispensable to complete security as it is unsurpassed for the service intended.

So, too, with Dampney protection. In boiler tubes and drums, where we initiated our program of maintenance for metal some thirty years ago, APEXIOR NUMBER 1 surfacing continues unexcelled as a simple, inexpensive means of securing a major investment.

For other power equipment — for metal serving wet or dry, under high heat or cold — there are specialized Dampney surfacing materials to guard against ills that threaten steel and so to assure superior performance.

Whether you are concerned with diesels or deaerators, tanks or turbines, boilers or breechings — give us the facts and we'll be happy to tell you what Dampney Maintenance for Metal can do for you.

For general data, ask for Product Bulletins 1500, 1530 and 1540.

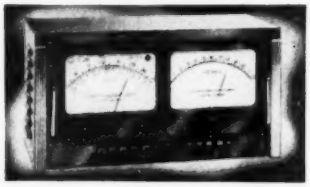
DAMPNEY Maintenance for Metal

THE DAMPNEY COMPANY of AMERICA • Hyde Park, Boston 36, Mass.

formity of magnetic field across drum width. Nonmagnetic wear-and-abrasion-resistant manganesge-alloy-steel drum shell revolves on sealed, self-aligning ball bearings while magnet inside drum remains stationary. Nonmagnetic material flows over the drum and drops vertically, while tramp iron is held fast to the drum by magnetic pull, dropping off when it passes out of the magnetic field.

Separator is available in designs that have the drum fully enclosed. Housing is of all metal dust-tight welded construction, equipped with completely enclosed electric motor and speed-reducer drive and top and bottom flanges for quick installation in chutes and ducts.

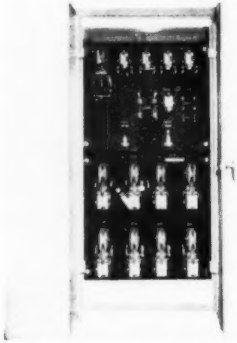
Dings Magnetic Separator Co, 4740 West Electric Ave, Milwaukee, Wis.



P961 • LIQUID-LEVEL GAGE Device indicates tank level within ±1/16 in. on a centrally located panel. Unit consists of transmitter located on tank and electronic receiver at central point.

Receivers are available for individual gauging up to 10 or up to 24 tanks. Readings may be received at more than one remote position by installing additional receivers.

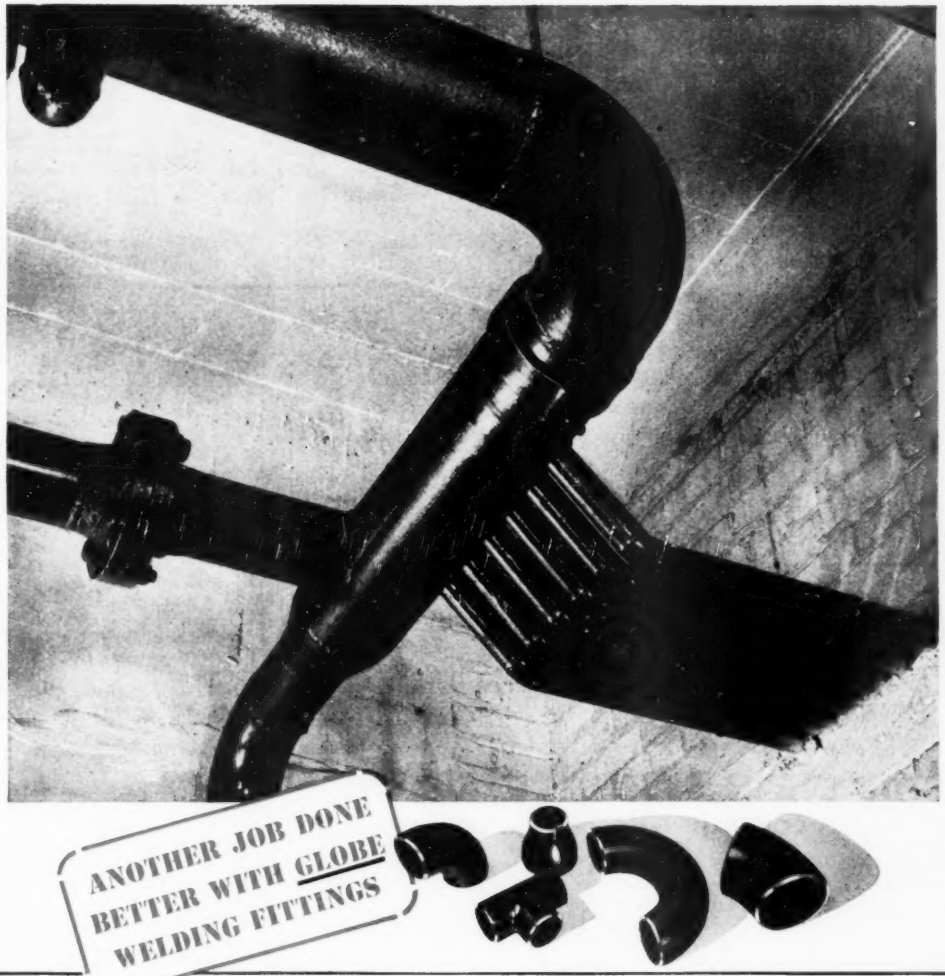
Vapor Recovery Systems Co, Compton, Calif.



P947 • CRANE HOIST CONTROL— Dc control is designed for use on whirley, revolver, gantry and overhead cranes in steel mills, shipyards, ore bridges, warehouses and on loading and unloading towers. This control provides power hoisting and power dynamic lowering, depending upon requirements of load on hook.

The change from power to dynamic braking lowering is inherent in the control and hence is independent of either operator or any particular control device. When retard-

How to Tame a Tough Joint



KEEP an eye on the future when you install piping — even the most innocent looking connection can become a "tough joint" through leakage — pressure-loss — the focal point for erosion and corrosion — constant maintenance time and cost.

You can tame probable "tough joints" in piping by making connections with permanently tight, leakproof Globe Welding Fittings. Strength is forged in the fittings — flow friction and pressure-loss minimized by precision formed true angles, radii, circularity—weight and space requirements reduced—exact dimensional accuracy that saves time, speeds piping assembly. To do any piping job better — use Globe Welding Fittings produced from Globe seamless steel tubes by the Globe Precision Process.

GLOBE STEEL TUBES CO., Milwaukee 4, Wis.

Producers of Globe seamless stainless steel tubes — Gloweld Welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe welding fittings.

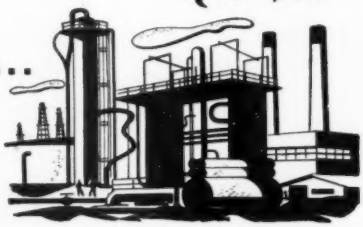
For complete information on sizes and types send for Globe Welding Fittings Catalog.

GLOBE PRECISION PROCESS WELDING FITTINGS

CORAVOL CASE HISTORY NO. 6

6th in a series describing CORAVOL results in steam systems

Type of Operation...



PETROLEUM REFINING

OPERATING CONDITIONS: Evaporation — 2,500,000 lbs. per 24 hours.
Make-up — 5½%
Operating pressure — 625 psi.

PROBLEM: Active corrosion in condensate return lines.
Carbon dioxide 40 to 50 parts per million.
pH of condensate, 5.0.
Iron in condensate up to 30 parts per million.

CORAVOL STARTED: June 1944.

RESULTS: Corrosion arrested.
pH of condensate maintained at 7.1 to 7.4.
Iron content of condensate reduced to zero.

USER COMMENTS: "By reducing the acidity of the condensate with CORAVOL, the pH of the water in the accumulator tank was raised. The use of CORAVOL at this plant has aided in corrosion control and it will continue to be used as conditions justify it."

STOP STEAM SYSTEM CORROSION

with **CORAVOL** (the original* AMINE PROCESS)

CORAVOL in your steam system (1) prevents corrosion in lines, (2) cleans out clogging rust deposits. Thus, CORAVOL *protects lines;* improves heat transfer; restores original capacity of lines and efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special formulas of treatment for: boiler feed water . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply.

*The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

WRITE TODAY for complete free data about the CORAVOL process.

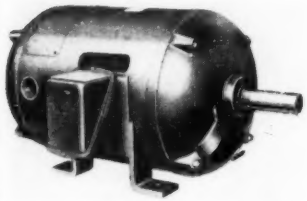
WESTERN CHEMICAL COMPANY

713 Washington Street — Kansas City 6, Missouri

ing, the speed is reduced automatically before solenoid brake sets, thus reducing mechanical-brake maintenance and protecting both motors and hoist equipment from excessive wear and shock.

In addition, both overshoot and down drift are eliminated. When master switch is thrown rapidly from the off to any lowering position, with a load on the hook, motor speed does not overshoot. Since first hoisting point will hold rated load with no downward drift, the master switch needs only to be moved to second hoisting point to lift load. A spring-closed contactor provides a dynamic braking circuit, thus assuring a retarded lowering speed even if magnet brake fails to hold an excessive load.

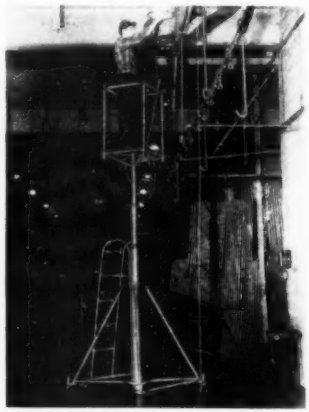
General Electric Co, Schenectady 5, N.Y.



P962 • WOUND-ROTOR MOTOR — In addition to standard dripproof enclosure, these motors are available splashproof and totally enclosed, non-ventilated. Motors are built in NEMA frames 224-505 in ratings up to 100 hp in larger frames up to 2000 hp.

Motors are for applications requiring smooth acceleration, high-starting torque with low-starting current, ability to start, stop or reverse frequently, or variable speed. They are suitable for driving conveyors, crushers, printing presses, fans, centrifugal compressors, etc.

Crocker-Wheeler Electric Mfg Co, Ampere, N.J.



P944 • MAINTENANCE TOWER — To speed overhead factory and building maintenance, a hydraulically raised, manually operated, rolling work tower is all-steel construction for maximum strength,

(Continued on page 210)

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

A4 **COOLERS** — Worthington Pump & Machy Corp, Harrison, N. J. Bulletin No. C-1100-S74 describes the UCY Series ammonia product coolers. Dimensions and specifications are given.

A5 **UNIT HEATERS** — Young Radiator Co, Racine, Wis. 16-page catalog No. 2645-A is a revised edition on Young's Vertiflow unit heaters. Contains tables and equations for applying these heaters to steam and hot water systems.

A6 **COOLING TOWER**—Marley Co, 3001 Fairfax Rd, Kansas City 15, Kansas. 4-page folder No. V-49 discusses the new Marley Verflow cooling tower. Illustrations and engineering data are included.

BOILERS AND AUXILIARIES

B4 **UNDERFEED SINGLE RETORT STOKER** — Detroit Stoker Co, General Motors Bldg, Detroit 2, Mich. 24-page booklet No. 550 covers construction of the Detroit LoStoker. Also gives diagrams, sizes and capacities.

B5 **GAGE ILLUMINATORS**—Jerguson Gage & Valve Co, 80 Fellsway, Somerville 45, Mass. Bulletin No. 117 features the new Jerguson gage illuminators. Illustrations of single section and double section illuminators are included.

B6 **BURNER LINE** — Coen Co, 40 Boardman Pl, San Francisco 3, Calif. 12-page brochure No. 48 tells about Coen burners and burner equipment for oil and gas firing. Application data, diagrams and tables are given.

B7 **GAS COMBUSTION EQUIPMENT** — Bryant Industrial Div, Affiliated Gas Equipment, Inc, 1020 London Rd, Cleveland 10, Ohio. Condensed catalog No. 292 describes and pictures 33 items of gas combustion equipment.

B8 **OIL-BURNING SYSTEMS**—Simplex Oil Heating Corp, 11 Park Pl, New York, N. Y. 4-page leaflet No. 122-41 contains informative data on Types HEG and HEGH horizontal oil-burning systems.

B9 **SINGLE-RETORT PLUNGER-FEED STOKERS** — Detroit Stoker Co, General Motors Bldg, Detroit 2, Mich. 24-page booklet No. 600 covers construction, operation and application of Detroit UniStokers.

B10 **REFRACTORIES** — Quigley Co, 527 Fifth Ave, New York 17, N. Y. Three bulletins are offered. No. KY 27-30 describes Kyram 27 and 30, ramming mixtures. No. HC-103T explains uses of Hearth-Crete, a chrome magnesite castable refractory, and No. CX-201c discusses Chromix, a plastic monolithic refractory.

CONTROLS, ELECTRIC

D3 **D-C BRAKE** — Control Divn, Apparatus Dept, General Electric, Schenectady, N. Y. 6-page folder No. GEA-5194 presents the new line of 2-shoe, 2-magnet d-c brakes. Design features, brake ratings and dimensions are given.

D4 **ELECTRIC CONTROL DEVICES** —Ward Leonard Electric Co, Mt. Vernon, N. Y. 8-page pamphlet No.

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

FILL OUT AND MAIL TODAY! NOT GOOD AFTER DEC 1, 1949

Write here number of item in which you are interested

Your Company Name.....

Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 9/49

Write here number of item in which you are interested

Your Company Name.....

Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 9/49

Write here number of item in which you are interested

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Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 9/49

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Your Name.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 9/49

Write here number of item in which you are interested

Your Company Name.....

Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 9/49

100,000 illustrates the company's complete line of rheostats, resistors, relays, motor starters, contactors, control accessories and dimmers.

D5 **CONTROLLERS** — Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. Leaflet No. PC-1 gives specifications and features of the Panelmount Capacitrol series of indicating, pyrometer controllers.

D6 **D-C CRANE CONTROL**—Control Divs, Apparatus Dept, General Electric, Schenectady, N. Y. 8-page booklet No. GEA-2292B tells about the new d-c crane hoist control. Illustrations and load characteristics are included.

CONTROLS, MECHANICAL

E1 **LIQUID - LEVEL CONTROLLERS**—Belfield Valve Div, Minneapolis-Honeywell Regulator Co, Philadelphia 44, Pa. 32-page bulletin No. 48-1 gives special construction features and typical applications of direct-connected and air-actuated controllers.

E2 **AUTOMATIC COMBUSTION CONTROL** — Coen Co, 40 Boardman Pl, San Francisco 3, Calif. Bulletin No. 40 discusses hydraulic operated, automatic combustion control for gas and oil firing boilers.

E3 **PRESSURE GAGES** — Bristol Co, Waterbury 91, Conn. Folder No. G620 covers the company's new series 500 absolute pressure gages. Description of the instrument and data on the new principle of operation employed is included.

E4 **OIL WELL PUMPING CONTROL** — Cutler-Hammer Inc, 394 N 12th St, Milwaukee 1, Wis. Publication No. CS-211 describes the Cutler-Hammer oil well pumping control, designed for across-the-line starting of squirrel cage motors.

ELECTRICAL EQUIPMENT

F5 **OIL CIRCUIT BREAKERS** — Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis. 4-page booklet No. 71B6129D discusses Allis-Chalmers' Types DZ-60B, DZ-100B and DZ-200B oil circuit breakers. Reference chart gives general dimensions.

F6 **WIRES AND CABLES**—National Electric Products Corp, Chamber of Commerce Bldg, Pittsburgh 19, Pa. 36-page catalog No. 509 gives informative data on NEAsbestus wires and cables which have asbestos or asbestos and varnished-cambric insulation.

F7 **ELECTRIC CONTACTS** — Fansteel Metallurgical Corp, North Chicago, Ill. 12-page bulletin No. 7.101 describes Fastell (R), a versatile group of materials made from metal powders for service as electrical contacts.

F8 **RECTIFIERS** — International Rectifier Corp, 6809 S Victoria Ave, Los Angeles 43, Calif. 6-page brochure No. C-349-848 contains operating characteristics, applications, circuit diagrams and design data on the company's standard line of full wave, single phase, bridge rectifiers.

F9 **INSTRUMENT PANELS**—Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. 4-page folder No. P1-1 furnishes prices and cut-out specifications on Wheelco cabinet type instrument panels.

F10 **RECTIFIERS**—Clark Electronic Laboratories, Palm Springs, Calif. Leaflet No. 121 features oil, air and water-cooled models of Celab industrial power rectifiers.

INSULATION, HEAT, COLD AND VIBRATION

H1 **PIPE INSULATION**—Kaylo Div, Owens-Illinois Glass Co, Box 1035, Toledo 1, Ohio. 4-page bulletin No. 4e/5 describes Kaylo pipe insulation. Contains complete information for specifying and using this calcium silicate insulating material which is effec-

H2 **VIBRATION CONTROL** — Korfund Co, 48-48-E, 32nd Pl, Long Island City 1, N. Y. 4-page booklet No. ER-701 tells about Elast-Rib, a cork and rubber mounting that requires no bolting or cementing, for controlling transmission of vibration and noise.

MAINTENANCE AND SAFETY EQUIPMENT

K1 **VISUAL OILERS** — Gits Bros Mfg Co, 1846 S Kilbourn Ave, Chicago 23, Ill. 8-page catalog shows latest line of Gits visual oilers. Detailed information, picture, capacity, thread, dimensions and prices on every oiler are included.

K2 **METAL CLEANING PROCESS**—American Wheelabrator & Equip Corp, 555 S Byrkit St, Mishawaka, Ind. 16-page brochure No. 584 discusses advantages of using Wheelabrator airless blast cleaning equipment. Numerous case history studies are shown.

MAINTENANCE MATERIALS

L5 **SILICONE GREASES** — Dow Corning Corp, Midland, Mich. 4-page folder No. D-5 on "Dow Corning Silicone Greases" gives the properties, performance and uses of these heat-stable and oxidation-resistant silicone lubricants.

L6 **INDUSTRIAL AND MARINE PACKINGS** — Crane Packing Co, 1800 Cuyler Ave, Chicago 13, Ill. 16-page catalog discusses John Crane packings for industrial and marine services.

L7 **SOOT REMOVER** — Alken-Murray Corp, 1841 Broadway, New York 23, N. Y. 4-page leaflet, entitled "Alken Certified Soot-Off," cites results obtained by using Soot-Off for soot, fire scale and slag control.

L8 **ALUMINUM PAINT**—Speco Inc, 7308 Associate Ave, Cleveland 9, Ohio. New data sheet and application bulletin describe Heat-Rem, a high heat-resisting aluminum paint.

L9 **BOILER CLEANER** — Sumco Products Inc, 144 Centre St, Brooklyn, N. Y. Brochure, entitled "Sumco Chemical Cleaning Service," explains the Sumco method for chemical cleaning of boilers, feed water heaters, condensers, diesel engines, piping, etc.

L10 **DRY LUBRICANT**—Alpha Corp, Greenwich, Conn. Bulletin No. 51 presents Molykote, a dry lubricant and anti-seizing compound. Applications and test results are given.

(*Continued on page* 200)

FIRST CLASS
PERMIT No. 64
(Sec. 510, P.L. & R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

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New York 18, N. Y.

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BUSINESS REPLY CARD
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POWER

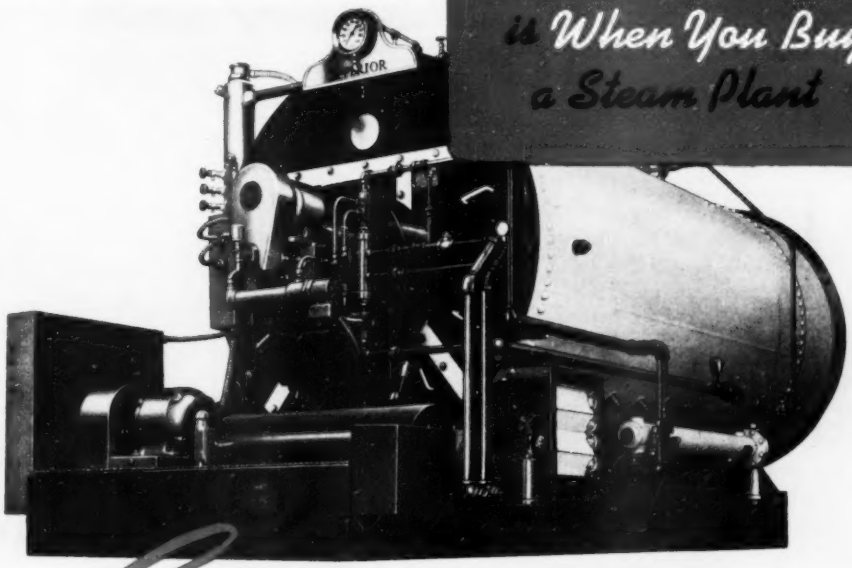
330 West 42nd Street

New York 18, N. Y.

The time to think of

OPERATING COSTS

is When You Buy a Steam Plant



Superior STEAM GENERATORS

PAY DIVIDENDS IN LONG-LIVED ECONOMY

Not for today alone . . . nor for the next few months . . . but for **years** to come . . . your Superior Steam Generator will continue to generate low-cost steam at high efficiency. Based upon long years of combustion engineering experience, its design embodies features which assure maximum long-run economy; for power engineers are well aware of the fact that an inefficient boiler can waste more than its cost in a few years.

Its rugged, heavy-duty construction is visible evidence of its long-lived dependability; for Superior's greater weight per boiler horse power, and larger heating surfaces contribute measurably to long-run economy . . . assuring performance at capacity ratings year after year after year.

Unlike the car you drive . . . which you trade in for a new model every few years . . . steam generators should be built to give long years of satisfactory service. Make sure that the steam generator you buy has the features which insure both long life **and** economy.

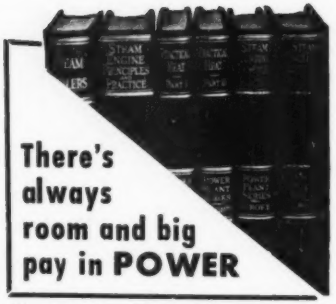
Look for fully automatic operation with any grade of oil . . . or gas . . . for fully automatic operation is truly an economy. Look into Superior's built-in induced draft. Compare heating and evaporating surfaces. Compare both size and weight.

Then see a Superior installation and observe the little details . . . wiring, fittings, its own specially designed burner, and last of all, its sturdy construction.

You **can** see the difference, if you'll look. For complete details write for Catalog 101.

Superior Combustion Industries, inc.

Factory: Emmaus, Pa.
Executive Offices: Times Tower, Times Square, New York 18, N. Y.



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Hundreds of men are using this practical library to reach the top in the power plant field. It brings you a complete education in power plant practice; it packs between the covers of 6 concise volumes a wealth of information on boilers, steam engines, steam turbines, pumps, boiler-feed apparatus, etc. Not only do you get the "how to" of every phase of power plant work, but this library gives you the fundamental principles in back of each phase and tells you "where," "when," and "why" a job should be done in a particular way.

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By TERRELL CROFT

6 volumes, 2477 pages, 2404 illustrations

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L11 **SILICONE GREASE**—Dow Corning Corp, Midland, Mich. 4-page folder No. D-6 contains information on how to use DC 44 silicone grease in electric motor bearings. Also included is a relubrication schedule for open or single shielded ball bearings operating at temperatures up to 250 F.

MATERIALS HANDLING

M4 **COAL DISTRIBUTOR**—Richardson Scale Co, Clifton, N. J. 4-page booklet No. 1349 features the Monorate, a non-segregating coal distributor for stoker firing. Illustrations and cross-section diagrams show the engineering principle involved.

M5 **CAR SHAKEOUT**—Robins Conveyors Div., Hewitt-Robins Inc, Passaic, N. J. 4-page brochure No. 130 introduces the new, lighter-weight Robins car shakeout, model 638, designed to unload up to 15 cars a day.

M6 **TRUCKS AND RACKS**—Barrett-Cravens Co, 4609 S Western Blvd, Chicago 9, Ill. 4-page catalog No. 4881, entitled "Time Savers," presents the various materials-handling equipment which supplement the basic Barrett lines; lift trucks, elevators and storage racks. Prices are included.

M7 **PORTABLE CONVEYORS**—Lake Shore Engrg Co, Iron Mountain, Mich. 8-page folder No. 495 shows Tote-All lightweight, portable power conveyors for handling bulk materials and packaged goods.

M8 **BULK WEIGHING SCALES** — Richardson Scale Co, Clifton, N. J. Two illustrated bulletins describe latest models of automatic bulk weighing machines. Bulletin No. 1549 gives complete information on the Richardson belt-fed Class 39 scale. Bulletin No. 1449 discusses the Class 40 scale, designed for optional methods of feed.

M9 **COAL HANDLING EQUIPMENT** —Baughman Mfg Co Inc, Jerseyville, Ill. Form No. A-121-6915M presents the Baughman Model No. 215 direct feed bin-to-stoker screw conveyor. Illustrations of adaptability are shown.

MECHANICAL TRANSMISSION

N4 **GEARMOTORS** — Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill. 12-page booklet No. 1815A illustrates and explains double and triple reduction units of new design, with Link-Belt motor mounted concentrically in line with the output shaft.

N5 **BELLOWS-TYPE SHAFT SEAL** — Crane Packing Co, 1800 Cuyler Ave, Chicago 13, Ill. 4-page brochure gives construction and operation data of the John Crane bellows-type shaft seal centrifugal and rotary pumps, refrigeration compressors, gear boxes and other industrial applications.

N6 **V-BELT DRIVE** — T B Wood's Sons Co, Chambersburg, Pa. 96-page catalog No. 192 contains stock drive tables, engineering data and examples for selecting a Sure-Grip V-belt drive. Also includes sections devoted to special drives, sheaves, V-belts and general engineering information.

N7 **SILENT CHAIN DRIVES**—Link-Belt Co, Ewart Plant, 220 S Belmont Ave, Indianapolis 6, Ind. 36-page book No. 2065 covers Link-Belt silent chain drives for automotive and industrial engines, busses and trucks. Tables of dimensions and illustrations are given.

METALS AND ALLOYS

R4 **MONEL** — International Nickel Co, 67 Wall St, New York 5, N. Y. 6-page folder, entitled "How To Eliminate Unnecessary Shutdowns," presents technical information on materials used for equipment in pulp and paper plants, with particular reference to that used for such specific items as washers, deckers, savealls, thickeners, filters, etc.

R5 **ALLOY STEELS** — American Manganese Steel Div, American Brake Shoe Co, Chicago Heights, Ill. 12-page bulletin No. 449-MI, discusses

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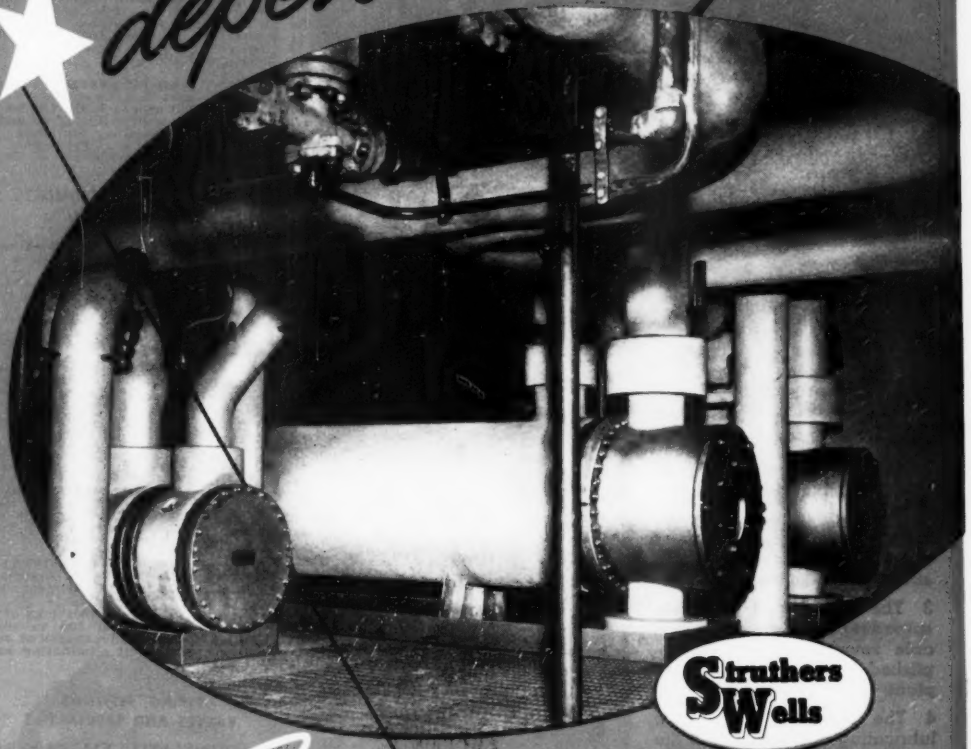

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alloy steels for ball mill liners and grates. Characteristics and uses of these alloys are described in detail with charts and pictures.

METERS AND INSTRUMENTS, ELECTRIC

S2 **ALARM SILENCER**—Automatic Control Co, 1005 University Ave, St. Paul 4, Minn. Booklet No. 7400 describes the Autocon Model ABS alarm silencer and lists suggested applications.

S3 **AC AND DC INSTRUMENTS** — Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. Leaflet No. AC-1 features a new line of ac and dc measuring, indicating, signaling and recording instruments. Price lists and specifications are included.

METERS AND INSTRUMENTS, MECHANICAL

T6 **FLOW RATE METER**—Simplex Valve & Meter Co, 68th & Upland Sts, Philadelphia 42, Pa. 18-page bulletin No. 400 contains sizes and capacities, construction, specifications and operation of the Type H meter, a flow rate indicating and recording meter.

T7 **FLOW METERS** — Builders-Providence Inc, 14 Codding St, Providence 1, R. I. 16-page brochure No. 400-F1 presents the Stauffo meter Model SMKS for steam, air or gas. Several pages are devoted to capacity tables while the rest give diagrams, description and features.

T8 **INDICATING GAGES** — Star Brass Div, Williams & Hussey Machine Co, Wilton, N. H. 4-page folder illustrates the Star line of superbronze noncorrosive indicating gages. Construction details, types, ranges as well as improvements that have been made are discussed.

T9 **INSULATION - RESISTANCE MEASUREMENT** — Associated Research Inc, 3758 W Belmont Ave, Chicago 18, Ill 4-page booklet No. 209 lists capacities and specifications of all Vibrotest models from 100 to 50,000 megohms and cites advantages of self-contained power unit eliminating hand cranking.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U7 **REGULATING VALVES**—Minneapolis-Honeywell Regulator Co, Belfield Valve Div, Philadelphia 44, Pa. 24-page catalog No. 47-1 contains information on the operating principle of the Belfield single seat pilot balanced regulating valves, Type FB. Included is a page of circumferences and areas of circles and flange dimension charts.

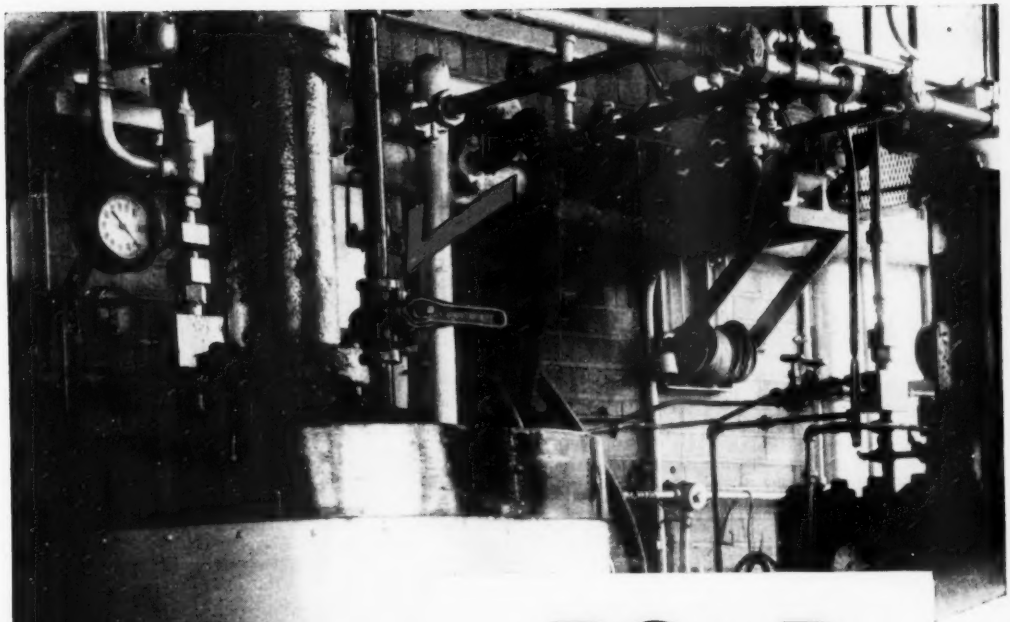
U8 **GLOBE AND ANGLE VALVES** — Kennedy Valve Mfg Co, Elmira, N. Y. Circular No. 101 describes Kennedy bronze globe and angle valves with renewable composition discs. A table of available sizes and dimensions is also given.

U9 **FUEL FIRING VALVES** — Coen Co, 40 Boardman Pl, San Francisco 3, Calif. Bulletin No. 40-1 presents performance characteristics, mechanical and material features of Coen AC (adjustable characteristic) fuel firing valves.

U10 **REGULATING AND FLOAT VALVES** — Minneapolis-Honeywell Regulator Co, Belfield Valve Div, Philadelphia 44, Pa. 24-page booklet No. 10-1 furnishes descriptive photographs, prices and dimension charts for various types of Belfield regulating valves for water, steam, air, gas or oil, and float valves.

PUMPS

W4 **CENTRIFUGAL PUMPS**—Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis. 16-page handbook No. 08X6256A discusses how and why of pump construction and their effect on pump maintenance. It also tells how



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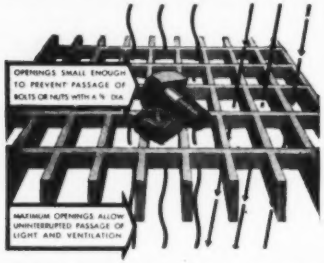
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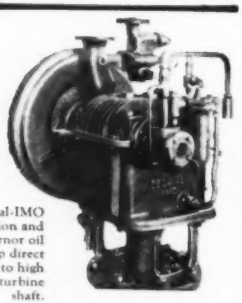

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to figure head and carries tables to help determine friction loss. Causes and cures for various sources of troubles are also given.

W5 **VERTICAL TURBINE PUMPS** — Worthington Pump & Machy Corp, Harrison, N. J. Bulletin No. H-450-B35 illustrates the oil-lubricated Worthington Type Q vertical turbine pumps in sizes from 6 - 14 in. having capacities from 50 - 3000 gpm.

W6 **TURBINE PUMPS** — Johnston Pump Co, 2324 E 49th St, Los Angeles 11, Calif. 8-page folder No. 1013 tells about the Johnston oil-lubricated pumps. Diagram shows construction of these pumps.

W7 **SELF-PRIMING CENTRIFUGAL PUMPS** — Marlow Pumps, Ridgewood, N. J. 12-page brochure No. 1B49 describes the four main Marlow types — long coupled, close coupled, vertical and belt driven — that cover 26 basic series of Marlow self-priming centrifugal pumps.

W8 **PUMP SETS** — Coen Co, 40 Boardman Pl, San Francisco 3, Calif. 4-page bulletin No. 30 discusses fuel-oil, pumping, heating and straining pump sets. Photos, diagrams and tables are included.

W9 **WATER LUBRICATED PUMP** — Johnston Pump Co, 2324 E 49th St, Los Angeles 11, Calif. 8-page folder No. 1014 features the Johnston water-lubricated turbine pump. Text deals with the many applications for which they are designed.

WELDING

Y3 **CASTINGS REPAIR** — Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. Reprint, entitled "Repairing Gray Iron Castings by Welding," offers practical case histories covering the repair and maintenance by welding of cast parts.

Y4 **WELDING GUIDE** — Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, Ohio. 20-page booklet No. 462 is a guide for selection of electrodes. Also relates welding techniques for mild steel and low-alloy high-tensile steels.

Y5 **TORCH OUTFIT** — Torch Div, Industrial Engineered Products Co, 7416 Melrose Ave, Los Angeles 46, Calif. 6-page catalog No. 88 and folder describe the Torchmaster torch outfit and its accessories.

OTHER EQUIPMENT

Z6 **COMPRESSORS** — Worthington Pump & Machy Corp, Harrison, N. J. 16-page bulletin No. H-620-B36 contains informative data on Worthington air-cooled compressors and dry vacuum pumps. Each is fully illustrated complete with pressure, sizes and ratings.

Z7 **HEAT EXCHANGER BAFFLE** — Henry Vogt Machine Co, 1000 W Ormsby St, Louisville 10, Ky. 4-page pamphlet tells about the new Vogt positive-seal baffle for 2 shell-pass heat exchangers.

Z8 **HIGH-RATE WATER-TREATING PLANT** — Infilco Inc, 325 W 25th Pl, Chicago 16, Ill. 28-page book No. 1825, gives a comprehensive story of the development of the Accelator. It explains its principle, distinguishing characteristics, advantages, design considerations, operation and applications.

Z9 **GAGE TESTER** — Star Brass Div, Williams & Hussey Machine Co, Wilton, N. H. 4-page brochure describes and illustrates the Star combination deadweight gage tester. Construction details and operating instructions are included.

Z10 **CAPACITOR INFORMATION** — General Electric Co, Apparatus Dept, Schenectady, N. Y. A wallet-size card No. GEN-22 contains rules of thumb for quickly computing the answers to the questions: How many kilovars; what power factor; how much voltage rise? Simplified diagrams illustrate the formula.

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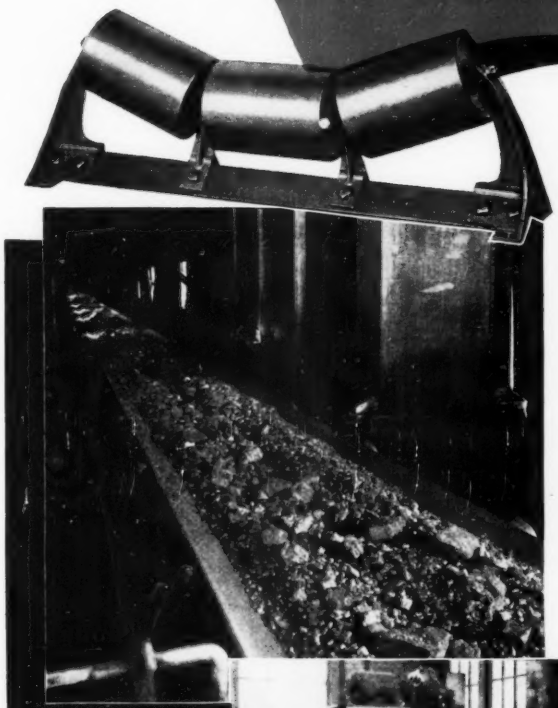

Keeping production moving without a break is important . . . fast-moving production lines require dependable and sturdy equipment . . . the kind that Jeffrey builds. Belt conveyors are sure fire in any well-organized handling systems. But Jeffrey also makes other types of conveyors . . . chain, apron, pivoted bucket, V-bucket, spiral, scraper and electric vibrating types . . . to help you coordinate your material handling requirements into a smooth-running system. We will be glad to study your needs . . . can supply technicians and engineers who know.

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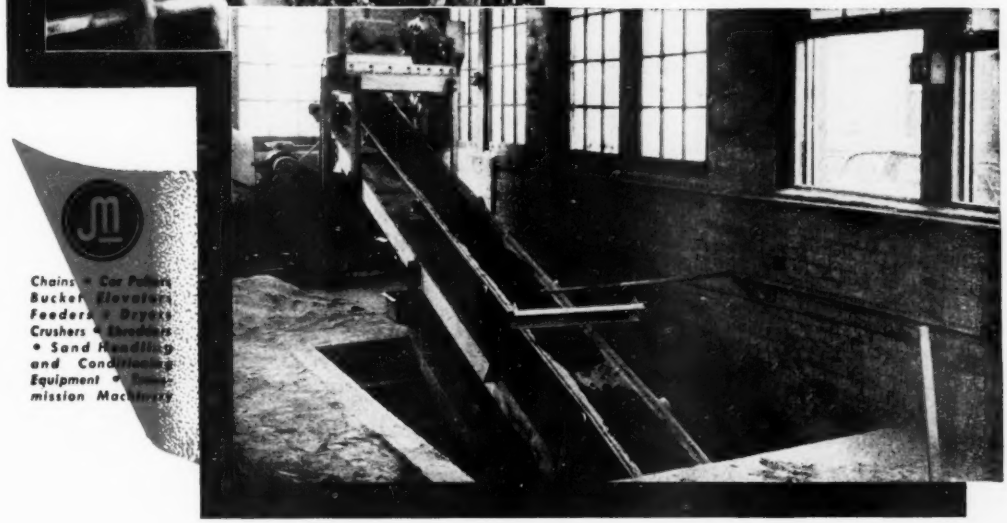

JM

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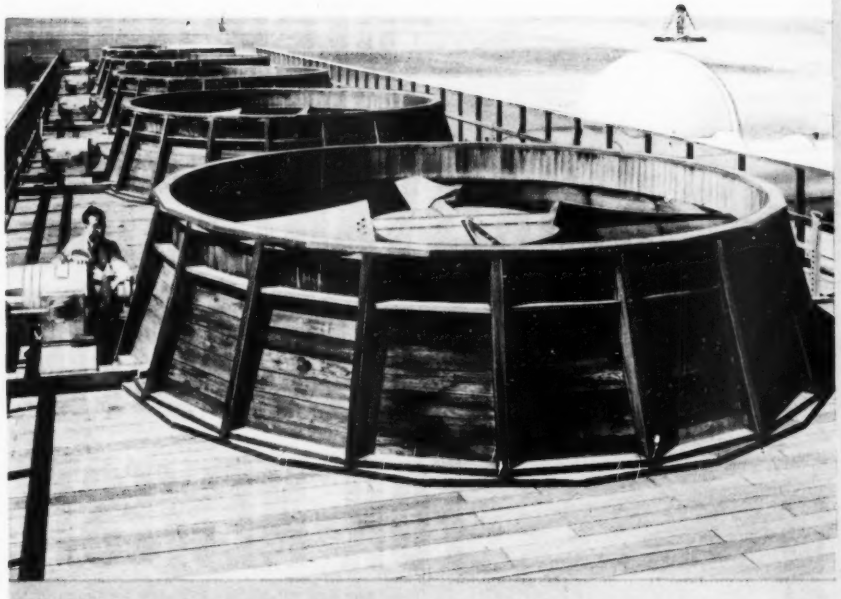
FOSTER WHEELER COOLING TOWERS

on many landscapes—in many climates



The cooling tower shown here serves the high speed engines operating the 6 by 6 foot supersonic wind tunnel of the NACA's Ames Aeronautical Laboratory at Moffet Field, California. It is an induced draft type of tower which was designed by Foster Wheeler engineers for high efficiency in cooling. The flexibility of this design, now standardized, enables Foster Wheeler to engineer and erect cooling towers for the requirements of any load anywhere in the world.

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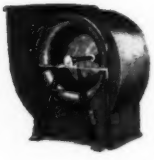
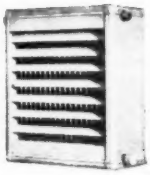


INDUSTRIAL FANS



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VANE CONTROL®

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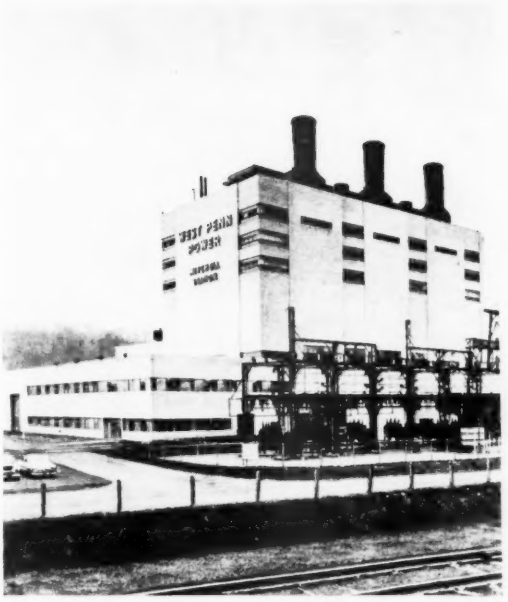
FACT #2:

West Penn Power knows the efficiency and reliability of Sturtevant mechanical draft equipment through experience. For example, more than twenty Sturtevant Induced Draft Fans with E-R Wheels were in use in various stations of the West Penn Power system before Sturtevant Fans were selected for the Mitchell Station.

FACT #3:

The E-R (Erosion Resisting) wheel is an exclusive Sturtevant product. The ingenious wheel construction and renewable wearing plates result in minimum fan outage due to erosion. Its wide acceptance is backed by numerous tried and proven installations in the country's largest power plants.



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In public utility or industry, these *facts* can pay off for you. Contact your nearest Sturtevant office, or, write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

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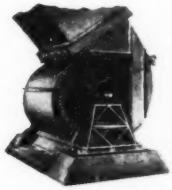

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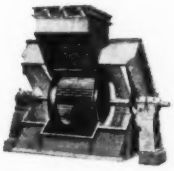

INDUCED DRAFT FANS
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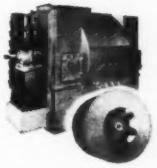

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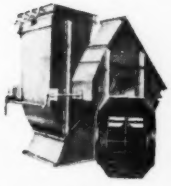

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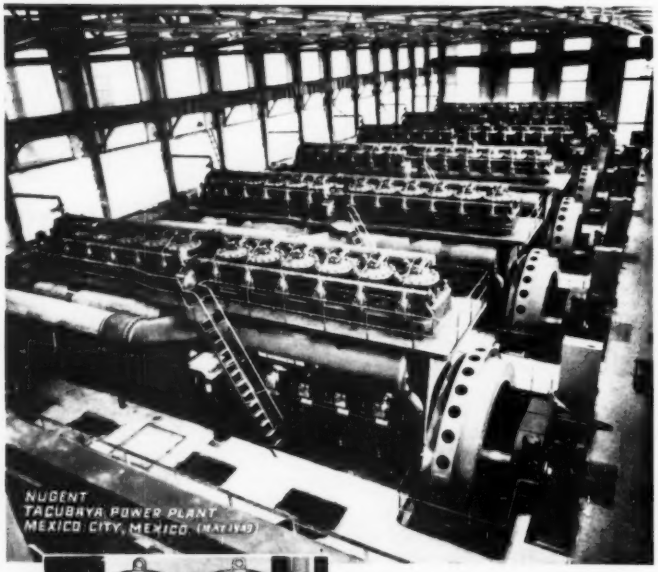
protect the world's largest diesel-electric public utility plant



In the large illustration above are shown the six 8650 H.P. Nordberg diesels at the Tacubaya Plant. The inset shows two of the twelve Nugent Filters installed to condition the fuel oil.

As the largest diesel-electric public utility plant in the world—the Tacubaya Plant, Mexico City — goes into service, the six 12 cylinder Nordberg diesels are protected by twelve Nugent Absorbent Depth Type Filters. A pair of filters is installed on each engine to condition the heavy oil which is used as fuel. Either filter can be used separately while the other is being cleaned or repacked. The filters have been designed to utilize replaceable filtering material which can be obtained locally.

Nugent is proud to have taken part in this important advancement of diesel power and extends its sincere congratulations to the Compania Mexicana de Luz Y Fuerza, S.A. and subsidiaries, the Comision Federal de Electricidad and the Nordberg Manufacturing Company.

Wm. W. Nugent & Co., Inc.
402 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles
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Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

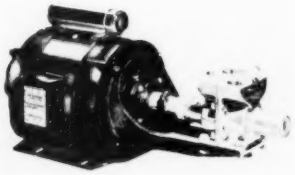
NEW EQUIPMENT

(*Continued from page* 198)

rigidity and worker safety. Controlled from work platform, the hydraulic lift is designed for one-man operation.

It may be easily raised or lowered rapidly. The tower can be rolled to any location on large swiveling casters with rubber tires.

Work may be performed at any platform level from 7 to 17 ft above floor. This makes it easy for most workers to reach equipment as high as 22 to 23 ft. An integral tubular steel ladder with hand rails provides easy access to the work platform when platform is in its retracted position. **Safway Steel Products, Inc, Milwaukee 13, Wis.**



P945 • PUMPING UNITS — General utility close-coupled motor-driven gearless pump units have ¼, ⅜, ½ and ¾ in. suction and discharge ports. Units have good suction lift for simple circulation work up to heavy duty against 150 psi head.

Motors are capacitor-start, induction-run ¼- 1/3- and ½-hp, single-phase models. Three-phase motors are also available. Each unit is resilient mounted and has an automatic thermal overload relay. Unit is supported on motor base.
Eco Engrg. Co, 12 New York Ave, Newark 1, N.J.

P932 • GEAR COUPLING—Made of forged high-carbon steel and with internal teeth running the full working length gives maximum strength to this oil-filled gear coupling made in ¾, 1, 1½, 2 and 2½ in. shaft sizes.

Since there are no bolts, the sleeve may be removed quickly. A snugly fitting neoprene seal keeps oil from leaking out and dirt from entering. This seal is reinforced with a garter spring and has sufficient resiliency to maintain constant closure against shaft surfaces. The hub teeth are cut radially, permitting accurate alignment without excessive backlash in the teeth. **Sier-Bath Gear & Pump Co, North Bergen, N.J.**

P901 • FLEXIBLE ABRASIVE—Fine grain abrasive material in eraser-like sticks comes in five sizes from ⅜ by ½ by 5 in. to 1 by 4 by 5 in.

Non-dusting, non-conductive and non-

This valuable, new bulletin, just off the press, shows you how to simplify the installation of modern, automatic, dependable coal storage and handling equipment ... reduce initial and operating costs.

It fully describes and illustrates a number of systems designed, built and installed by G-W for steam generating plants. Each installation is a typical example of the *right* one of the four basic types of G-W Storage Systems efficiently and economically meeting plant conditions of space, of climate, of capacity and of allowable initial

Although no two coal handling problems are exactly alike, 140 years of experience have taught G-W that practically all of them fall within the four basic design patterns. G-W's thorough knowledge gained in applying this proved engineering principle to hundreds of installations can help you solve your coal storage and handling problem at low cost.

If you plan to modernize your present facilities or to install a new system, you'll find G-W Bulletin No. 300 extremely helpful ... and most profitable. Mail coupon or write for your *free* copy today!

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Please send, without cost or obligation, a copy of "Coal Handling Equipment," Bulletin No. 300.

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Unrestricted flow is assured with

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"The UNION with the RECESSED BRASS SEAT"

Male-Female 90° Union Elbow

Location of the Recessed Brass Seat in all Jefferson Unions is such that threaded pipe ends cannot come in contact with it. Furthermore this design leaves the runway absolutely unobstructed thereby assuring free flow through the fitting. In manufacturing the Brass Ring is forced into a precision machined channel so that in effect it becomes one piece with the iron. Each Union is air-tested before shipment to insure drop-tightness.

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63 Geoding St., Lockport, N. Y.

19 Fletcher Ave., Lexington 73, Mass.

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For isolation of Light from Power, or Light from Telephone

EISLER TRANSFORMERS *are manufactured strictly to Standards of the N.E.M.A., A.S.A., and A.I.E.E.*

WRITE FOR SPECIAL CATALOG

EISLER ENGINEERING CO., INC.

Chas. Eisler, Pres.

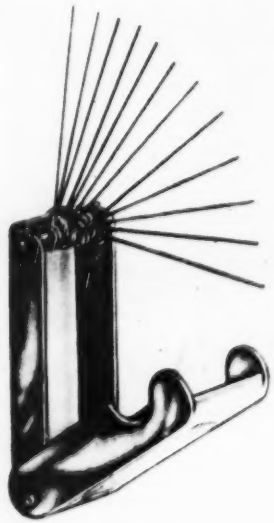
757 South 13th Street, Newark 3, N. J.

loading abrasive can be used for commutator and slip-ring maintenance. It also removes tool marks, scratches or rust on copper, brass, bronze, iron, steel, aluminum and other metals.

Ideal Industries, Inc, 1025 Park Ave, Sycamore, Ill.

P922 • FIRE HOSE—Constructed with a natural rubber tube, two plies of chemically-treated cotton cloth fabric and a neoprene cover, fire hose is highly resistant to acids, acid fumes, oil and gasoline. Hose is able to withstand a test pressure of 400 psi. The hose is marketed in two colors, white or black, under the trade name *Matchless Carbolized Fire Hose.*

United States Rubber Co, Rockefeller Center, New York 20, N.Y.



P910 • WELDING CLEANER — Easy cleaning of welding tips can be had with use of *Spiral Thermo Tip* cleaners.

Tip-cleaner is spiral-made with rounded ridges that clean out carbon and slag from welding tips. The spiral design prevents breakage of cleaning rods.

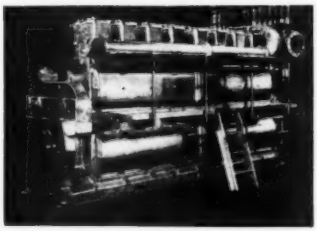
Thermacote Co, Newark, N.J.

P939 • FLEXIBLE COUPLING — Silent-chain flexible couplings are of all steel construction. Two sprockets wrapped with a center guide silent chain assures easy installation. Disconnection is done by unwrapping the chain after removing the single connecting pin, or by moving either sprocket endwise out of mesh with the chain.

Stock bores range from 1/2 to 2 7/8 in. for capacities up to 119 hp at 2000 rpm. Two covers are available—stamped steel for economy and plastic for maximum protection.

Morse Chain Co, 7601 Central Ave, Detroit 8, Mich.

The ALCO PLAN for DIESEL ECONOMY



Flexibility and Low Cost Offered by ALCO Standardized Engine

THE ALCO plan helps Diesel plants where flexibility, economy, dependability, and provision for future growth are important. In one size of stationary Diesel engine, ALCO offers unusual advantages where multiples of 540 to 1,300 horsepower can be used.

LOW COST...This basic design, also used in ALCO switch engines, is quantity-produced to make both first cost and the cost of replacement parts unusually low.

FLEXIBILITY...You can fit fluctuating load curves more closely than with fewer engines of larger size, or of varied capacity.

LESS WEAR...This more efficient use of engines means less wear per installed horsepower. The unused capacity of operating engines at any time need not exceed the capacity of one engine. There is no wear on the idle engines. Larger engines would necessitate greater wear per installed horsepower, with resulting higher costs.

GREATER EFFICIENCY...With engines operating near rated load, fuel consumption is less and operating conditions are better.

UNIFORM ENGINE WEAR...With several units of the same size, engines can be operated in rotation, allowing planned inspection and maintenance with minimum "down time."

STAND-BY ECONOMY...When all units are the same size, stand-by capacity can be limited to one size of engine the same as all others. With a variety of engine sizes, stand-by capacity might easily have to equal the largest single unit.

SIMPLIFIED MAINTENANCE...Uniform engine size means uniformity of replacement parts and of maintenance procedures; smaller stocks of parts; minimum of special tools; shorter "down time."

EASY GROWTH...As demand increases, gradual growth can take place by adding extra units of the same size.

• • •

What your actual savings can be with this compact, efficient engine should be computed carefully. Call in an ALCO engineer to discuss the ALCO plan in relation to your needs.

AMERICAN LOCOMOTIVE COMPANY

Department D-6, 30 Church Street, New York 7, N. Y.

ALCO

STANDARDIZED

DIESEL ENGINES

*COLOR

For maximum production . . . top efficiency . . . lowest operating cost, give your machines the finest in lubricants—give them Tycol oils and greases.

Tycol lubricants are made to meet every lubrication need of industry—from roll neck greases for steel mills to spindle oils for textile plants.

Each Tycol lubricant is subjected to rigid tests during manufacture. This control assures the required lubrication characteristics—*COLOR, penetration, viscosity, to name a few—for maximum performance of that particular product. At every step from selection of crudes to blending of the finished product, Tycol lubricants provide maximum lubricating efficiency which means greater economy, longer life for every type of equipment.

Tide Water Associated will be glad to assist you in selecting the Tycol lubricant best suited to your specific need. Call or write your nearest office for further details.

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*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA"

This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

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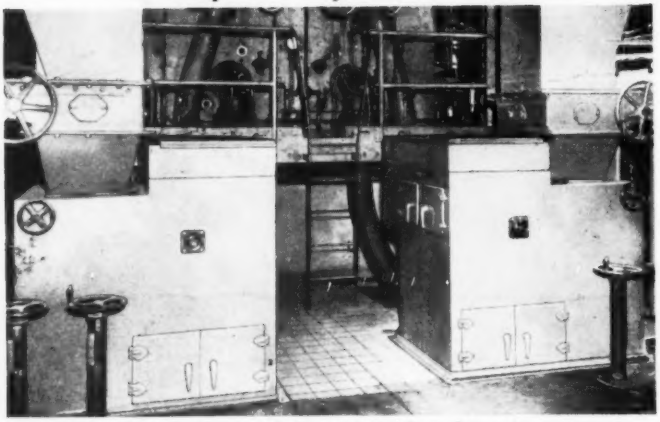
helping balance a 440,000,000 ton-diet



Two Richardson 200 lb. Coal Scales at Rockland Light and Power Company's new Hudson Plant

The total annual rated capacity of Richardson Coal Scales serving steam generating plants in public utilities and industrials is greater than the estimated 440 million tons of coal consumed industrially throughout the nation last year.

Leading surveys of latest developments in central station and industrial power plant design trends emphasize the importance of fuel economy. When it comes to checking coal consumption the reasons for preference for Richardson Scales are obvious. By weighing every ounce of coal accurately to ¼ of 1%, day in and day out, they provide a positive check on coal used in relation to power produced...identify wasteful boilers and permit correction of inefficiencies before fuel losses become serious. Thus they contribute importantly to lower power costs.

The extensive Richardson line of equipment for weighing, conveying and feeding coal includes a model ideally suited to your space layout and capacity requirements... stationary floor-mounted models, stationary and portable models mounted at mid-section, and combination conveyor and elongated scales. Dust-proof, pressure-tight housing contributes substantially to plant cleanliness.

Why not trust Richardson's unrivalled experience—50 years old—to weigh your coal from bunker to stoker (or pulverizer)? Hundreds of public utilities, municipalities and industries do.

RICHARDSON

RICHARDSON SCALE COMPANY, Clifton, N. J.

ATLANTA • BOSTON • BUFFALO • CHICAGO • MINNEAPOLIS • WICHITA

NEW YORK • OMAHA • PHILADELPHIA • SAN FRANCISCO • DETROIT • PITTSBURGH • MONTREAL • TORONTO

POWER NEWS

(*Continued from page 156*)

become president of Steam Appliance Co, now Republic Flow Meters Co, manufacturers of industrial instruments and controls.

During World War I, Cunningham served as a second lieutenant in the Air Service, U. S. Army. He is a director of Autogas Co, Baltimore and Ohio Railroad Co, Belden Mfg Co, Lake Shore National Bank and Lumbermens Mutual Casualty Co, Public Service Co of Northern Ill. and Allis-Chalmers Mfg Co. Also, he is a member of the Western Society of Engineers, Illinois Manufacturers Assn, and the Chicago, Union League, Commercial and Indian Hill Clubs.

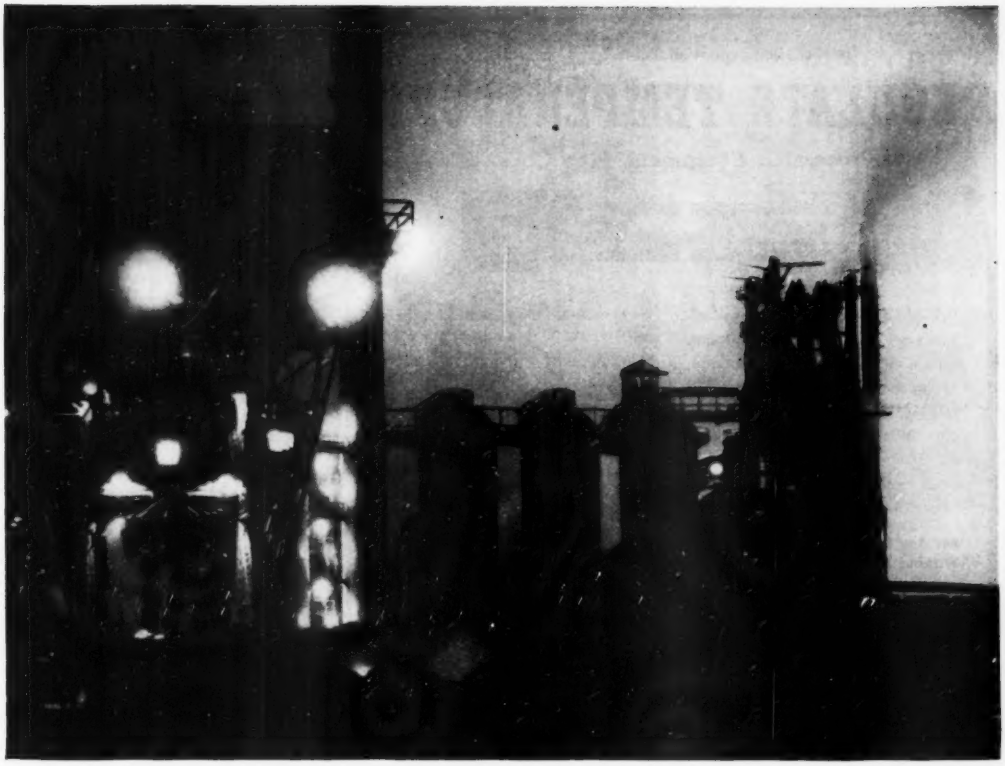
Regional vice-presidents nominated are: (1) Frank M Gunby (renomination) of Charles T Main, Inc, Boston (2) Professor John C Reed, head of mechanical engineering dept, Bucknell University, Lewisburg, Pa. (3) Albert C Pasini, assistant superintendent, production dept, Detriot Edison Co, Detroit (4) Samuel H Graf, director, engineering experimental station, Oregon State College, Corvallis, Ore.

The following were nominated as directors-at-large: (1) Thomas E Purcell, general superintendent, power stations, Duquesne Light Co, Pittsburgh (2) Benjamin P Graves, director of design, Brown & Sharpe Mfg Co, Providence, R. I.

Worthington Pump and Machinery Corp, Harrison, N. J., announces expansion of water-treating equipment sales div and transfer of that div to the corporation's Dunellen Works, at Dunellen, N. J. The transfer had been made from Harrison Works, where this equipment has been produced for the past ten years, because of increased activity in this field and the fact that Dunellen Works production facilities are particularly well suited to this kind of manufacture. The products involved in the transfer are hot-process water softeners of deaerating and non-deaerating types; cold-process, slurry-type softeners and coagulators; zeolite softeners including deionizing systems; and pressure filters for general-purpose filtration.

Standard Stoker Co has recently acquired complete control of Chicago Automatic Stoker. This spreader stoker, with some 20 years of successful performance behind it, now becomes a Standard Stoker product. It is now being built at Standard's Erie, Pa., plant.

Manzel, Inc, through Herbert H Roosa, vice-president, has announced price reductions of 5% on Manzel automatic lubricators and chemical feeders. This reduction was made effective July 19.



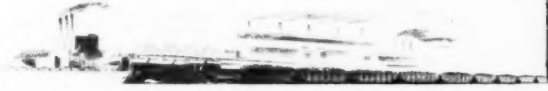
There is no shortage of good coking coals on the Baltimore & Ohio

To steel men looking for better coking bituminous, we recommend coals mined on the Baltimore & Ohio. *We know these coals.* They are low in sulphur and ash, and excel in other characteristics needed for efficient coking.

Not only is there an abundant present supply of coking coals on the B & O, but because of developing fields, B & O's *reserves* are increasing. B & O bituminous answers the need of blending for better coke and offers both accessibility and long-range availability. *Ask our man!*

BITUMINOUS COALS FOR EVERY PURPOSE

—from modern mines like this →



LINKING 13 GREAT STATES WITH THE NATION

B & O

BALTIMORE & OHIO RAILROAD

Constantly *doing things* **—better!**

Use Nicholson Expansion Steam Traps Also to

REGULATE TEMPERATURE

of Processing Equipment, Pipe Coils, etc.

In addition to their long-proved effectiveness as a freezeproof, quiet, automatic means of drainage, Nicholson expansion steam traps are increasingly serving as a low-cost, efficient temperature regulator for processing and heating equipment. Write for installation information.

For Any Pressure from 0 to 250 lbs. Without Change of Valve or Seat

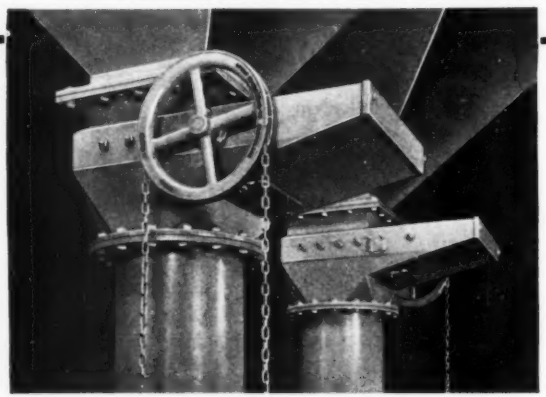
The valve can be easily adjusted to pass condensate at any temperature below 212° F., and thus regulate the temperature of equipment drained. Other features: easily installed; discharge air as efficiently as water; no air-binding; hardened stainless steel valve, seat. Lengths, 18" to 40". Pressures, 0 to 250 lbs., without change of valve or seat.

FOR ALL EQUIPMENT
Using Steam or Hot Water

Radiators
Separators
Paper Machinery
Pipe Coils
Kettles
Railway Coaches
Dry Kilns
Vulcanizers
Switch Heaters
Laundries
Plastic Molding Presses

Catalog 448 or see Sweet's

W. H. NICHOLSON & CO., 125 Oregon St., Wilkes-Barre, Pa.



S-E-CO. COAL VALVES are available in many sizes and types. Sizes range from 6" to 30". Either round or square flanges are available. Top of valve may be flanged or equipped with studs. Handwheel or chain operation available.

Write for dimension sheets

STOCK ENGINEERING COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

New Officers for James G Biddle Co

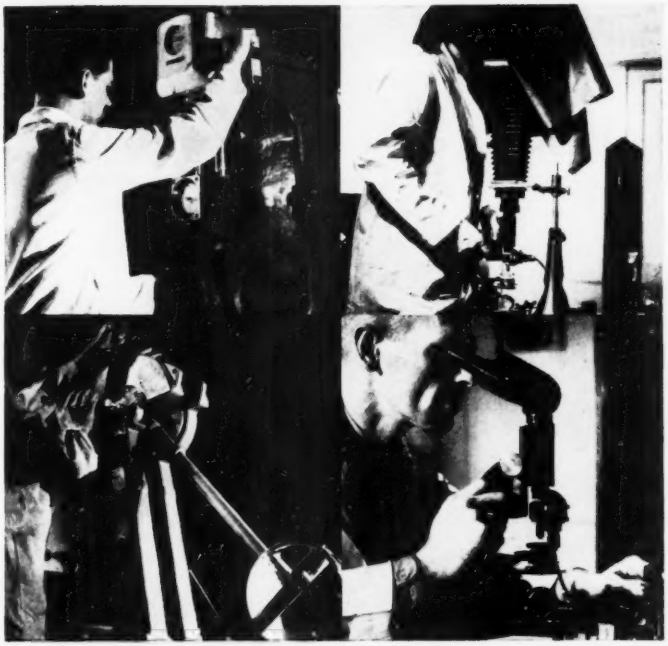
D Robert Yarnall has moved up from the presidency of James G Biddle Co, which he held from 1944, to the post of chairman of the board. He is succeeded in the presidency by J Robert James, former vice-president and treasurer. Mr. Yarnall is well-known as president of Yarnall-Waring Co and past-president of ASME. Mr. James joined James G Biddle Co in 1930 and became vice-president and treasurer in 1944. Prior to his connection with James G Biddle Co, Mr. James was associated with J E Rhoades & Sons of Wilmington, Del.

Edward H Wannemacher was re-elected vice-president and secretary. He is also sales manager and personnel director. Additional appointments are: E E Lange, asst sales mgr; A Q Lange, technical sales engr; T B Whitson, director of engrg; E B Curdts, asst director of engrg; and Stuart C Sommer, advertising mgr.

Emulsion Extinguishment of Oil Fires With Water Sprays is fully demonstrated with spectacular fires in full color, and a running commentary with explanation of how and why it works in scenes photographed through the microscope for a 16-mm sound, Kodachrome film. Available for free showing before engineering groups, schools, fire protection organizations, fire departments, oil-refinery executives, electrical and power utilities, etc, the film presents for the first time a complete summary of results of 15 years of pioneering and successful accomplishment in putting out oil fires with water. The method gives protection against flash-back of fires in medium and heavy oils and quick extinguishment of fires in the light oils including kerosene. The film runs about 20 min at sound speed and showings may be scheduled for groups having 16-mm sound projectors by writing to *General Sales Manager's Office, K P Jones, Grinnell Co, Providence 1, R.I.*

Commercial Testing and Engrg Co, Chicago 1, Ill., announces a change in name of its engineering dept to Carroll, Bechtel and Langtry. The engineering dept of the company was organized at the end of World War I. Since that time it has specialized in power-plant consulting engineering and combustion efficiency. To increase operating economy of a power plant means saving of money and thus lowers cost of output unit. To this end it has been deemed advisable to organize this dept as a separate unit, effective last July 1, but to remain a subsidiary of the Commercial Testing & Engrg Co, which will make more feasible the handling of a greater volume of engineering tests, estimates and recommendations for boilers, stokers, turbines, etc. Introducing the engineering dept under this new name also gives credit to the engineers in direct charge as well as their assistants, all of whom have spent a lifetime in such engineering service.

Florida Power & Light Co plans to double present capacity of its Sarasota generating station. Work on the expansion is to start in the immediate future, according to President McGregor Smith.



Raw material control means better Tube-Turn welding fittings

What's a piece of steel made of?

THE quality of a finished product is largely dependent on the quality of the raw material from which it is made. That's why Tube Turns' laboratory technicians thoroughly test every lot of seamless steel tubing received in the Tube Turns, Inc. plant.

Answers to that important question —*What's a piece of steel made of?*— are determined in two ways. First, by chemical tests that disclose the exact percentage of the various elements present in the steel. And, second, by physical tests to determine the steel's tensile strength, yield strength, and elongation. Unless the steel measures up in all respects, the entire lot is rejected.

At the end of these tests, not only is the chemical composition of the steel known, but an accurate appraisal of its metallurgical and physical characteristics has been made. And these facts are filed by the laboratory control number rolled into each fitting to identify it permanently with the lot of steel from which it was made.

This rigid control over raw material is your assurance of basic quality in the Tube-Turn welding fittings you buy. Modern equipment in the hands of skilled technicians permit only the best steel to be used for the manufacture of Tube-Turn products.

Remember, you can always bank on good service in good connections every time you specify "Tube-Turn."

TUBE TURNS, INC.

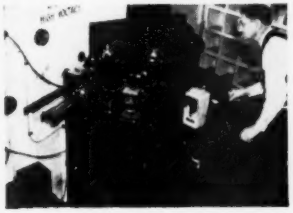
236 East Broadway, Dept. J, Louisville 1, Kentucky

District Offices at New York, Philadelphia, Pittsburgh, Chicago, Houston, Tulsa, San Francisco, Los Angeles

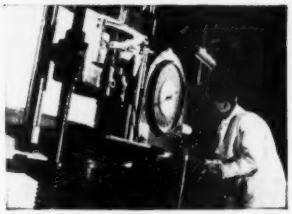
TUBE-TURN

tt

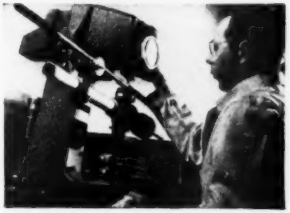
WELDING FITTINGS AND FLANGES



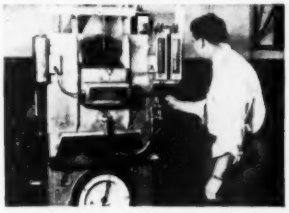
Foolproof chemical analysis of steel is made quickly and accurately on this Spectroscope, typical of the modern equipment used by Tube Turns, Inc. in the control of raw material.



Tensile strength of all seamless steel tubing is accurately measured on this machine, capable of exerting a force of 60,000 pounds. Yield strength and ductility are also checked here.

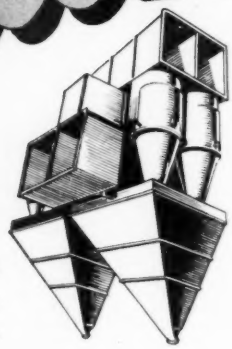


Periodic checks on the hardness of the steel are made with this Rockwell instrument to determine the strength, ductility, and machinability of the material. Brinell equipment is also used to check hardness.



Advance indication of what will happen to the steel during processing is determined with this electric furnace, one of a battery. Heat treatment to which the material will be subjected is duplicated here.

The Straight-line Approach to Collecting fly-ash



no blind alleys

if you recognize the problem for what it is, an engineering job for specialists. True, when it comes to equipment, Buell's exclusive van Tongeren 'Shave-Off' gives the Buell Cyclone System unique advantage. But in the fundamental engineering, in the analysis of your fly-ash into its fractional components of graded micron sizes, and in the sizing of equipment for maximum performance—at this stage Buell engineering service is invaluable. No cost or obligation is involved . . . because we build only tailored-to-measure installations, we sell by engineering the job from the ground up. Let us send you our 32-page brochure, 'Engineered Efficiency', as a general introduction. Write: Buell Engineering Co., 70 Pine Street, Suite 5045, New York 5, N. Y.

buell

Engineered Efficiency in

DUST COLLECTION

Manufacturing in the United States and Canada for shipment throughout North and South America.

DEMA Sets Up Fall Educational Program

Diesel Engine Manufacturers Assn has plans set up this fall for their educational program of cooperation with the engineering colleges and universities of the country.

Starting off the program was a diesel symposium at Madison, Wis., the week of Aug 29, under sponsorship of University of Wisconsin and DEMA. About 100 professors from the engineering schools throughout the U. S. and 50 engineers from the diesel engine industry attended this symposium.

Supplementing and following this intensive week will be a series of four meetings of one day each in different regions of the country, where professors will visit plants where diesel-engine products are made and listen to diesel engineers talk about subjects of practical interest to educators teaching in diesel-engine fields.

The first of these meetings will be on Oct 18 at Springfield, Mass., plant of American Bosch Corp. The second one will be at Illinois Institute of Technology in Chicago, with the day's program sponsored by Illinois Testing Laboratories, Inc, Burgess-Manning Co, William W Nugent & Co, DeLuxe Products Corp, Standard Oil Co (Ind.) and Diesel Engrg & Mfg Corp. The third day's program will be in Cleveland at diesel-engine div plant of General Motors Corp. Air-Maze Corp and Cleveland Graphite Bronze Co will cooperate with General Motors Corp in presenting this program. The fourth conference will be at University of Denver and will be attended by representatives from mountain-state schools and engineers from the diesel-engine industry.

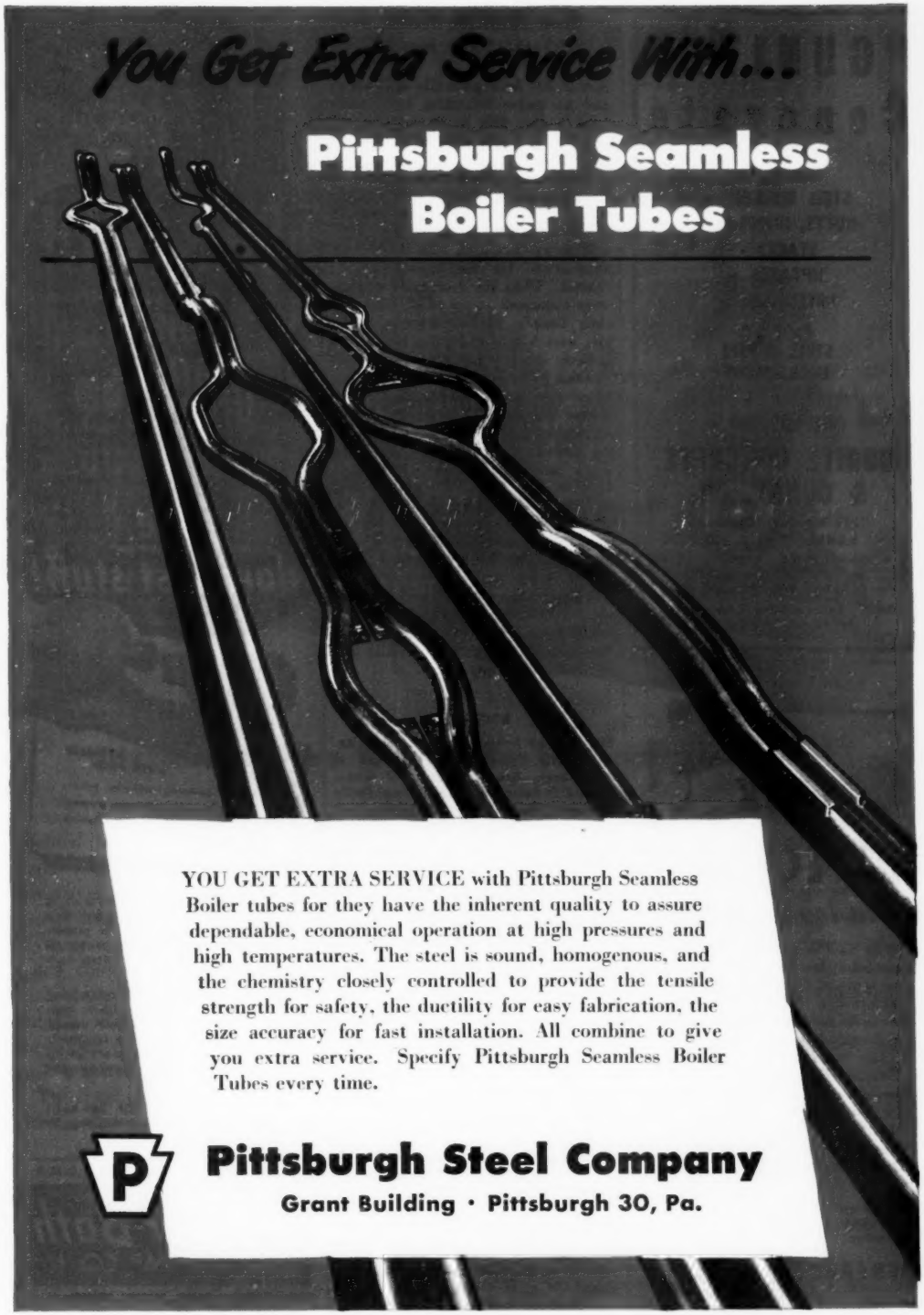
Dravo Corp, Pittsburgh, Pa., has been awarded a contract to construct a river barge unloading terminal and other coal-handling facilities at the Frank R Phillips power station of Duquesne Light Co at Wireton, Pa. Completion of the barge unloader, designed to handle 500 tons of coal an hour, is scheduled for Dec. The additional coal-handling facilities are part of a major expansion program at the Phillips Station to meet increasing demands for electricity. Dravo now is building two additions to the power station that will more than triple its present generating capacity. The station supplies current to Duquesne Light's 66,000-v transmission network serving an area 120 miles in circumference, covering some 800 sq mi.

The coal unloader will be built on a concrete-capped sheet-steel caisson, having a dia of 38 ft 2 in., located adjacent to west bank of Ohio River about 20 mi northwest of Pittsburgh. Coal will be transported there by barge from mines along Mohongahela River above Pittsburgh.

On July 1, 1949, Utilities Electrical Machinery Corp had been reincorporated under name of Utilities Machinery Corp, as dealers in new and used large power-plant machinery, with the new address at National City-East Sixth Bldg, Cleveland 14, Ohio. The officers are J W Kohn, president; M S Kohn, general manager; and George Kohn, vice-president.

You Get Extra Service With...

Pittsburgh Seamless Boiler Tubes



YOU GET EXTRA SERVICE with Pittsburgh Seamless Boiler tubes for they have the inherent quality to assure dependable, economical operation at high pressures and high temperatures. The steel is sound, homogenous, and the chemistry closely controlled to provide the tensile strength for safety, the ductility for easy fabrication, the size accuracy for fast installation. All combine to give you extra service. Specify Pittsburgh Seamless Boiler Tubes every time.

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find leaks quickly

With G-E leak detectors you can easily locate even the smallest leaks in closed systems. Detectors are ideal for locating leaks in installed equipment or in the products you make.

Use the Type H detector for pressure systems, the Type M for evacuated systems.* Write for Bulletin GEC-233 (Type H) or for GEC-336 (Type M). *Address Apparatus Dept., A687-21, General Electric Co., Schenectady 5, New York.*

**If the system is filled with combustible gas, write for special application information.*

GENERAL ELECTRIC

GEI-21

GAS-BURNING DIESELS

(Continued from page 80)

eration has been generally satisfactory and no major difficulties have developed in over 6000 hr on the first unit installed and over 4500 hr on the second unit.

Switchgear. Along the south side of the plant building stands new Westinghouse metal-clad switchgear serving the entire plant. Six generator-control sections are provided, with instruments appropriate for the capacities they control. When the four existing units were connected to the new switchgear their General Electric voltage regulators were transferred to the new board.

Each of six outgoing feeder-circuit sections has inverse-time-limit breaker-tripping relays. Breakers on all generator and feeder sections are 2400-v air breakers with 50,000-kva interrupting capacity. All incoming and outgoing cables run in ducts or tunnels beneath the floor. Switchboard also includes exciter, surge-protection and totalizing-meter sections, with a swinging bracket carrying voltmeters, frequency meters and synchroscope.

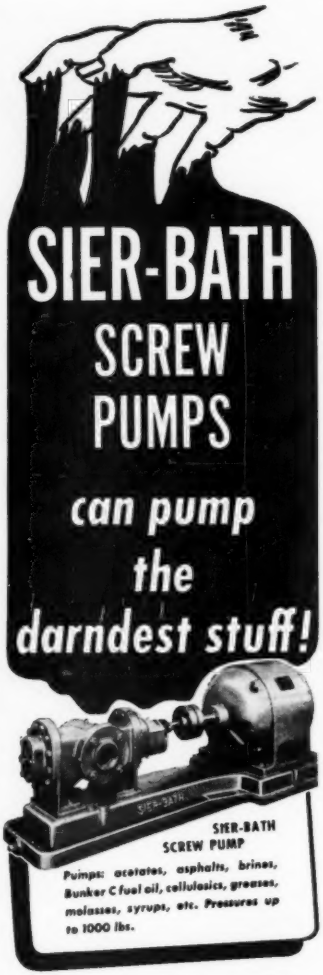
J H Bender, city manager, acted as the city's engineer for design, plans, specifications and construction supervision, assisted by J D Armstrong, chief power-plant engineer. Construction and erection was by city forces.

BOOKLETS

TELLING THE STORY OF ENGINEERING RESEARCH. *By Herbert B Nichols, John M McCullough, Ron Ross, Irving J Gitlin, Edward D Fales, Paul Wooton and Philip W Swain. Published by Engineering College Research Council of American Society for Engineering Education.* 52 *pp,* 9x6 *in., illustrated, paper,* 50¢. *Office of the Chairman, Engineering College Research Council, State University of Iowa, Iowa City, Iowa.* Engineers and other scientists anxious to report their accomplishments and methods to laymen will find help in this new booklet. In simple and straight-forward terms seven nationally known editors and science writers tell engineers and scientists how they may present the story of their activities through all the various media available, thus fulfilling what the editor has called "the obligation of interpretation." The booklet contains the full texts of seven addresses given before the winter meeting of the Engineering College Research Council in Nov 1948.

INDUSTRIAL USES OF RADIOACTIVE MATERIALS. 13 *pp,* 11x8½ *in., paper. Available without charge from Arthur D Little, Inc, Cambridge* 42, *Mass.* Bibliography discusses use of radioactive materials, particularly radioactive tracers as applied to industrial processes and research. References to various books on this subject are given.

(Continued on page 222)



No matter how gooey the stuff, it can't "gum up the works" in a Sier-Bath Screw Pump. The powerful thrust of its screw moves materials so viscous that they are often in a semi-solid condition.

The simple design (only two moving parts) and accurate but sturdy construction, make these screw pumps long-lived and keep them relatively free of maintenance. They are available in horizontal and vertical models. Send for booklet.

ALSO MANUFACTURERS OF SIER-BATH GEAREX ROTARY PUMPS AND SIER-BATH PRECISION GEARS

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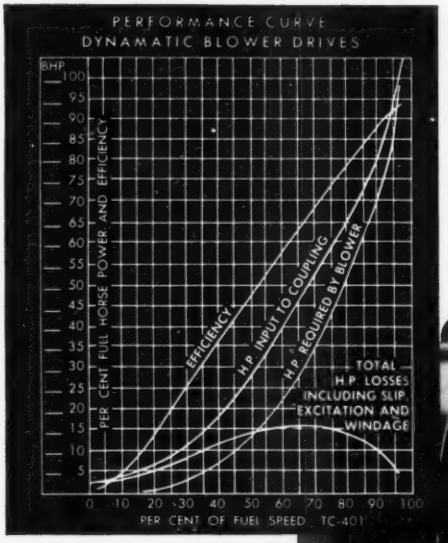
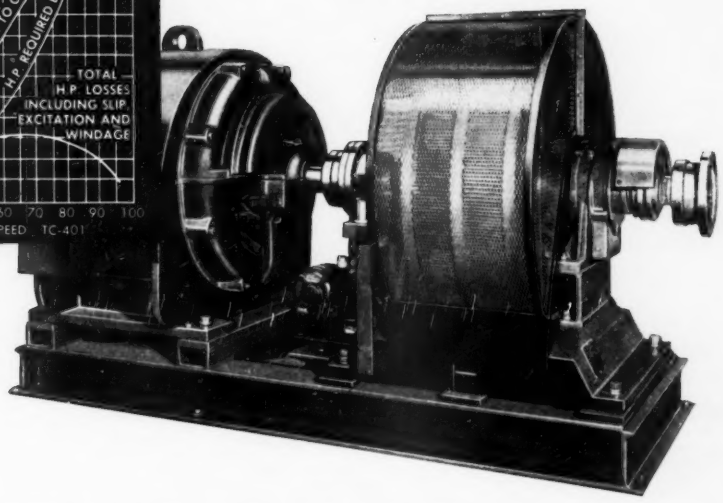


EATON DYNAMATIC BLOWER DRIVES



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Dynamatic Variable Speed Couplings are ideally adapted to such applications as regulating air drafts in steam generating stations, power house fan drives, public utility induced draft fans, and forced draft fans. Controls can be made to change the output speed of the coupling and hold that speed constant. Response is instantaneous and load changes are closely followed. The speed range available is practically infinite, and can be controlled precisely from ten per cent speed up to full speed.

The performance curve above indicates the characteristics of Dynamatic couplings when driving fans or blowers. Fundamentally, all fans and blowers will have curves very close to the ideal curves shown in this figure. Note the desirable relationship between efficiency, horsepower input, and required horsepower. The horsepower losses indicated are normal for this type of application. Both air cooled and water cooled types of Dynamatic couplings are available, selection depending upon loads and type of service involved. The electric-slip coupling was developed and introduced by Dynamatic; this company has pioneered the use of electric-slip couplings in fan and blower drive applications. Write for illustrated literature.

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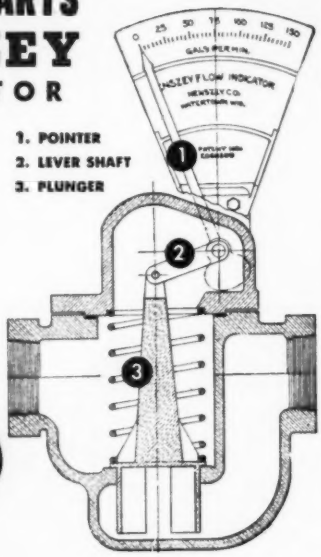
There are only three moving parts in the Henszey Flow Indicator—the Pointer, the Lever Shaft and the Plunger. And that means longer wear, continued service, and constant accuracy.

The liquid enters the indicator below the plunger, forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots, so that the lift of the plunger is in direct proportion to the rate of flow of the liquid. The graduations on the dial are uniformly spaced from one end to another and read direct — without constants. The entire instrument can be installed right in the pipe line.



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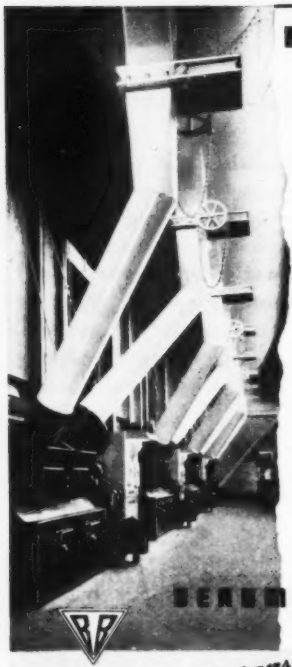

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...and INSTALL BEAUMONT ANTI-FRICTION GATES

● Many utilities are replacing their present gates with Beaumont improved anti-friction type gates. Since the first order from one utility in 1942, many repeat orders have been received for installation in this company's other power plants.

In all cases, these gates have given very satisfactory service. According to one user, "No trouble whatever has been experienced opening and closing these gates—and no maintenance has been necessary other than periodic greasing".

Many leading plants throughout the country are finding it economical and time-saving to install Beaumont trouble-free type gates such as those pictured at left. Follow the leaders and do the same. These gates are made in sizes from 14" to 30". Request complete information.

One contract—one responsibility

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Designers Manufacturers Erectors **COAL AND ASH HANDLING SYSTEMS**

ATTIC VENTILATION CODE, SECOND EDITION. 6 *pp*, 11x8½ *in., paper. Prepared by Engineering Committee of Propeller Fan Manufacturers' Assn. Available without charge from Propeller Fan Manufacturers' Assn*, 2157 *Guardian Bldg, Detroit* 26, *Mich.* Second edition has been rewritten to include new material, such as illustrations of typical discharge openings, method of computing areas for attic fan-discharge vents, and minimum air changes recommended for attic ventilation systems in the United States.

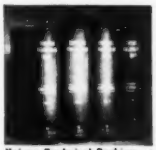
PAPERS PRESENTED AT THE FIRST SHORT COURSE ON HOT WATER AND STEAM HEATING SYSTEMS HELD AT THE UNDERGRADUATE DIV, UNIVERSITY OF ILLINOIS, NAVY PIER, CHICAGO. 108 *pp*, 9x6 *in., paper*, 50¢. *Known as Circular No.* 54, *it is available from Engineering Experiment Station, University of Illinois, Urbana, Ill.* Booklet discusses heat loss calculations; flow of fluids through pipe; factors affecting comfort; types, location, and performance of radiation; operation of a trade association; customer relations in the heating business; indirect heating of domestic hot water; and pumps and controls.

CATALOG 1949 — BOOKS AND PERIODICALS. 63 *pp*, 8½x5½ *in., paper. Available without charge from Interscience Publishers, Inc*, 215 *Fourth Ave, New York* 3, *N. Y.* This catalog is a complete listing of Interscience publications in print or in active preparation on chemistry, physics, mathematics, metallurgy, engineering, medicine, physiology, biology, and general science.

INSTRUMENTATION FOR COAL HYDROGENATION PROCESSING (1949). 20 *pp*; 6x9; *illustrated, plus foldout chart. Copies available on request to Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Philadelphia* 44, *Pa.* This booklet is the result of an agreement with the U. S. Bureau of Mines for informing industry concerning what is termed the "brains" of the coal-to-oil demonstration plant at Louisiana, Mo. In this plant the Bureau has taken advantage of modern industrial instrumentation in operating a complex process. Many supplementary instruments have been installed for experimental purposes. Booklet describes equipment of all makes and its relationship to the process. It should be of interest to all engineers concerned with instrumentation.

SIMPLIFIED METHOD FOR COMPUTING CONCENTRATION AT GROUND LEVEL OF SMOKE AND DUST ISSUING FROM A STACK (1949). *By J M DallaValle, Assoc Prof Chemical Engrg, Georgia Inst of Technology.* 4 *pp*; 8½x11; *foldout nomogram*, $1. *Copies obtainable from J M DallaValle.* What happens to dust particles leaving a stack is a matter of concern to engineers trying to solve air-pollution problems. This pamphlet, published by the author, develops a procedure for computing the concentration of particles at ground level, and presents a nomogram giving values of free-fall velocity for particles of different size and density, plus a series of curves facilitating the solution of the general equation.

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.



Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.

View of Public Service Electric and Gas Company's new 1500 psig., 1050 F. power station at Sewaren, N. J.

These "firsts" mean piping that lives longer

IN ADDITION to laboratory tests and actual performance figures, there are still other ways to predict the probable life of power piping. One is to look at the record of the company that fabricates the piping—to see what unusual challenges it has met and solved.

Here are three recent fabricating problems overcome by Kellogg, all connected with the high temperature piping at Public Service Electric and Gas Company's new Sewaren Generating Station in New Jersey.

Kellogg was the first to fabricate power piping to operate at 1050 F. It was not a simple job. Nothing could be allowed to go wrong in piping as important as this.

As part of this job Kellogg also fabricated the first 18-8 alloy steel (power) piping for high temperature service. It was designed to connect the throttle valves and steam chests of three turbines operating at 1500 psig. There just couldn't be any defects, any locked-up stresses, any faulty metal formations, or deviations from contour.

In addition, Kellogg created for this same plant a special bi-metallic transition piece through the use of an exclusive electric ingot casting process. It was the first of its kind and was cleverly devised to make a junction, between Croloy boiler leads and Stainless Steel (Type 347 and 316) throttle valves, that eliminated the possibility of failure from expansion stress. This piece precluded the necessity for a tricky welding job that might fail because of a 50% difference in thermal expansion between the two alloys.

These are just some recent Kellogg "firsts" to keep in mind when you place orders for power piping today. You know that each piece of piping delivered, bearing the Kellogg stamp, has not only thirty years of experience behind it, but also the creative thought that met and bested these unusual challenges. You can be sure that know-how like this means power piping that lives longer.

To master temperature, pressure and chemicals use

M. W. KELLOGG

process equipment

VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman, Inc.) — Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

You Need a KENNEDY Hydraulic-Control Valve . . .

WHERE valves are installed in inaccessible locations.

WHERE rapid opening or closing of valves is desired.

WHERE numerous valves are to be operated frequently.

WHERE easy opening of extra-large valves is desired.

FIG. 611 FTR. Bronze cylinder with Tie-Rods, standard up to 12" diameter.

FIG. 611 F. Cast-Iron, Bronze-Lined Cylinders, standard over 12" diameter.

KENNEDY Hydraulic or Cylinder-Control Gate Valves are available for steam, air, oil or cold water service.

Actuated by water, air or oil under pressure, the valve is controlled by a four-way valve located on any reliable pressure-supply line within reasonable distance from the valve. Piston rod extends through cylinder and indicates position of the discs.

Pressure must be maintained in the cylinder on Hydraulic-Control Gate Valves to hold the closed position, unless valve stem is horizontal or hanging vertically from the disc.

Use the check list below and write for further details and prices of KENNEDY Hydraulic-Control Valves to meet your particular requirements.

CHECK LIST FOR INQUIRIES AND ORDERS

- ☐ Size of valve and whether bronze or cast iron bronze-lined cylinder.
- ☐ Working or test pressure and actual unbalanced pressure on discs.
- ☐ Type connection; flanged, bell ends, or special.
- ☐ Position of valve in pipe line.
- ☐ Dependable pressure available for cylinder operation and whether cold water, air or oil, etc.
- ☐ Brief description of installation, fluid or gas controlled, frequency of operation and function of the valve.

THE KENNEDY VALVE MFG. CO.
1060 EAST WATER ST.
ELMIRA, NEW YORK
VALVES • PIPE FITTINGS • FIRE HYDRANTS

OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES

APPOINTMENTS

James G Biddle Co, Philadelphia, Pa., elects D Robert Yarnall chairman of the board and J Robert James, president. Additional appointments are as follows: E F Lange, assistant sales manager; A Q Lange, technical sales engineer; T B Whitson, director of engineering; E B Curdts, assistant director of engineering; and Stuart C Sommer, advertising manager. Edward H Wannemacher is re-elected vice-president and secretary.

R K Hampton becomes resident manager of **Beaumont Birch Co's** new offices located at 50 Church St, New York, N. Y.

Bigelow-Liptak Corp, Detroit, has selected Stapp Engrg Co, 512 Tabor Bldg, Denver, Colo., as its representative in Colorado, Wyoming, New Mexico and portions of Nebraska, South Dakota and Texas. Also, William T Macdonald and Kenneth Gregory have been appointed sales representatives. Macdonald will be in Cleveland at 900 E 72nd St, and will handle northern Ohio territory. Gregory will work out of Detroit throughout Michigan area, previously handled by Walter F Welsh who recently passed away.

William J Tunny is now superintendent of electrical maintenance at the Indiana Harbor plants of **Youngstown Sheet & Tube Co.**

Weston Electrical Instrument Corp and its subsidiary, **C J Tagliabue Corp,** have established a district sales office at 6230 3rd St, N W, Washington, D. C., with Lawrence F Parachini as district manager. This office will serve the District of Columbia and adjacent counties.

W W Pyeatt rejoins **Black, Sivalls & Bryson Inc** to direct the company's New Orleans, La., sales office.

Combustion Engrg-Superheater Inc announces that the sales territory formerly covered by W Z Harrison & Co, Salt Lake City, Utah, has been divided between Joy & Cox, Denver, and the Los Angeles office of the company. Joy & Cox will handle Montana, western Wyoming, Idaho and Utah, while Nevada is assigned to Combustion's Los Angeles office.

Hebert H Walther Jr is promoted to development engineer for **Dowell Inc** at Richmond, Va. This sales outpost is now enlarged to a station. The following are made sales engineers: Marvin E Johnston, Pratt, Kansas; Larkin L Blake, Lafayette, La.; and Clarence R Olson Jr, at El Reno, Okla. Also, B E McCann is in charge of new station at Sullivan, Ind. He will be assisted by J R Jay.

Eward Valves Inc names Herbert J Rowe sales engineer for the Great Lakes region. Rowe makes his headquarters at the home office in East Chicago, Ind.

Clisby Associates, Inc, 904 Sixth Ave, N, Birmingham, Ala., has been appointed distributor for **Dravo** Counterflo heaters in central and northern Alabama. The firm will also distribute Dravo crane cab coolers

Fact File on Preheat

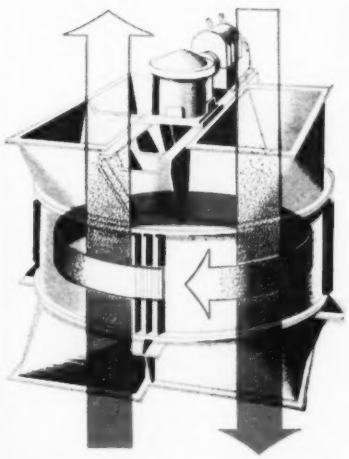
No. 4

The free area of the gas and air passages through the Ljungstrom heating elements is maintained at design levels by a simple cleaning routine, accomplished during operation.

A high-velocity jet built in the cold end of the unit moves radially across the rotor elements, cleaning them of soot or fly ash.

In service — as in design — our engineers apply for your benefit 26 years of experience gained at Ljungstrom-equipped plants.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gas-to-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of leading power plants and other special applications confirm its high level of heat recovery and long-term low maintenance service.

THE

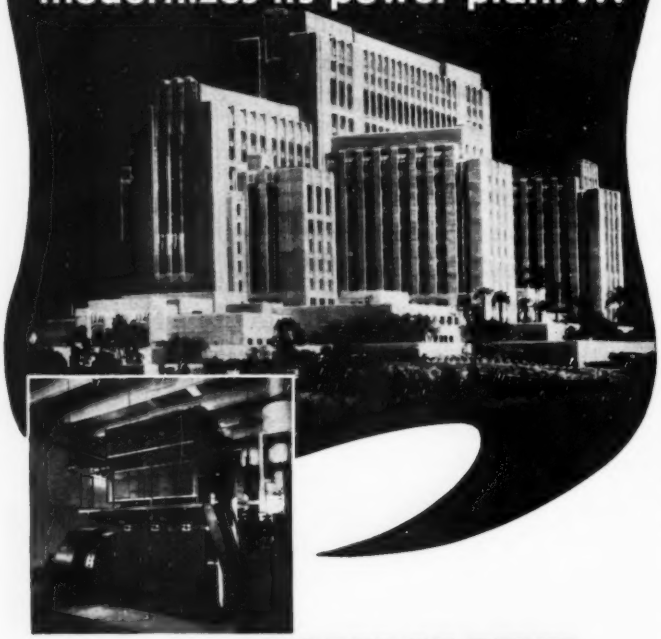
AIR PREHEATER CORPORATION

60 EAST 42ND STREET • NEW YORK 17, N. Y.

Plant: Wellsville, N. Y. 1806

the Los Angeles County General Hospital

modernizes its power plant . . .



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"Universal Unaflow" STEAM ENGINE

Modern in architecture, modern in scientific equipment, and modern in efficiency, the enlarged and remodelled Los Angeles County General Hospital takes its place among the leading institutions of its kind in the United States.

An important factor in that modernization program is the Skinner "Universal Unaflow" Steam Engine. The installation is a vertical three-cylinder, poppet-valve engine with 600-kw., 250-volt, direct current generator.

The Los Angeles County General Hospital is one of thousands of institutions, schools, hotels, office buildings and manufacturing plants enjoying the economy and dependability of Skinner "Universal Unaflow" Engines for generating electric power or for driving compressors, blowers, pumps, lineshafts or other load.

Our engineers will make accurate estimates to prove you can produce dependable power at a fraction of the cost of purchased power. Write for detailed information of the advantages of Skinner "Universal Unaflow" Engines in your field.

For Over 80 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

in all of Alabama and northwest Florida. The Alabama heater territory does not include DeKalb, Madison or Jackson counties.

L J Wing Mfg Co selects Albert D Becker as its representative for eastern section of New York State, Vermont and Berkshire County in Massachusetts. Becker will maintain offices at 434 Clinton Ave, Albany, N. Y. Fred McMeans represents the company for the Province of British Columbia, Canada. His headquarters are at 451 W Broadway, Vancouver, B. C.

T M Robie is now director of quality control for **Fairbanks, Morse & Co's** Beloit, Wis., works. J W Wright succeeds Robie as manager of the diesel div in Chicago.

Construction materials dept, **General Electric Co,** announces formation of a new Northwest sales district, which will serve the wholesale trading areas of Seattle and Spokane, Wash.; Portland, Ore.; Boise, Idaho; Salt Lake City, Utah; and Butte and Billings, Mont. William W Bryan and George E Wickman are district manager and manager of sales, respectively. A new Pacific district warehouse at 3000 E 46th St, Los Angeles, is now open to serve the western trading area of California, Arizona and the western half of Nevada. Daniel F Flynn is district manager and George F Kingshot, operating manager. In addition, Lloyd C Shackelford becomes wire and cable specialist with headquarters in Seattle, Wash. Edward J Roddy Jr is named district representative for wholesale trading areas of Zanesville and Columbus, Ohio, and will make his headquarters in the latter city.

Charles W Owens has been appointed superintendent of the Birmingham works, Fairfield, Ala., of **Harbison-Walker Refractories Co.**

Homestead Valve Mfg Co, Coraopolis, Pa., announces following elections: F E Schuchman, president; W R Schuchman, chairman of the board; J E Roth, chairman of the advisory committee; Bradley McCormick, secretary; and N E Kolesar, assistant treasurer.

Hines Bearings & Industrial Supply Co, Billings, Mont., has been chosen distributor for **Hewitt-Robins Inc,** in Billings and surrounding area.

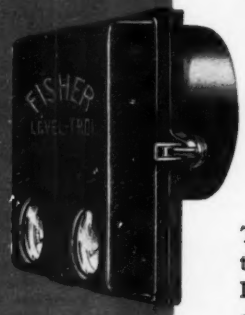
Robert H Hull assumes duties of sales manager of engineered pump lines at Indianapolis, Ind., works of Peerless Pump Div, **Food Machinery & Chemical Corp.** Frank W McCann is now manager of Atlantic district sales with offices at 37 Wall St, New York City. McCann's territory includes all New England and Middle Atlantic states.

Nordberg Mfg Co, Milwaukee, Wis., promotes B T Eagerton to vice-president-in-charge of the export div.

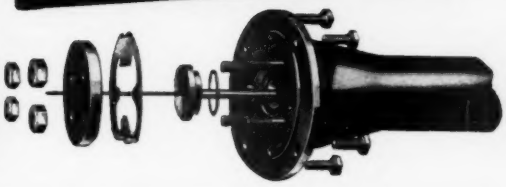
E E Goehringer assumes sales and engineering responsibility in the Indianapolis area as district manager for **Lincoln Electric Co.** Omer Blodgett is transferred to Chicago office. In addition to duties of

FISHER LEVEL-TROL

REMOVABLE, REPLACEABLE TORQUE TUBE



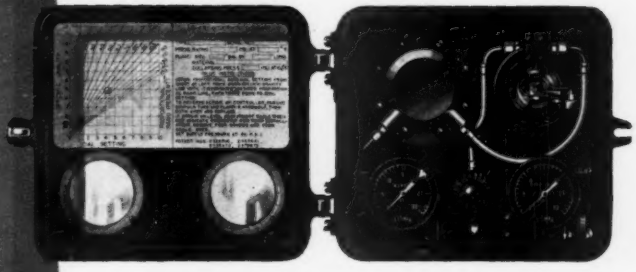
Mounting detail of pilot and torque tube

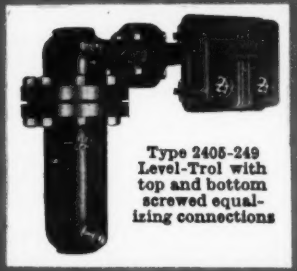


Type 2405-249 makes it possible for the operator to exchange or replace the torque tube in a Fisher Level-Trol without dismantling the entire level controller or breaking into pressure piping. All Fisher Level-Trols are furnished with this improved feature.

ONLY ONE CONTROL FOR PROPORTIONAL BAND AND SPECIFIC GRAVITY ADJUSTMENT

Type 2405 Level-Trol Pilot





Type 2405-249 Level-Trol with top and bottom screwed equalizing connections

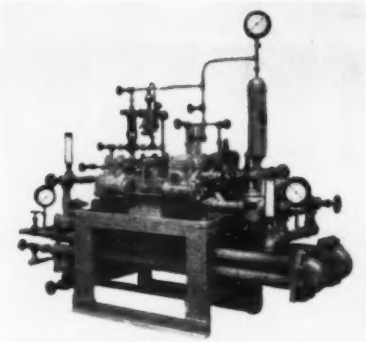
As easy as tuning a radio. Control knob readily accessible, provided with calibrated scale to indicate setting. Pilot is entirely pneumatic in operation. No intervening links or mechanical joints. High tensile iron, pressure tight, weather proof case with hinged gasket sealed cover.

Write today for Bulletin F-2

FISHER GOVERNOR COMPANY, MARSHALLTOWN, IOWA

LOCKETT FUEL OIL PUMPING AND HEATING SETS

Custom Built



The efficient, compact unit illustrated consists of two Worthington Duplex Steam Pumps and two Griscom Russell Twin G-Fin Fuel Oil Heaters mounted on a single structural steel frame.

FOR almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex Steam Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump-and-heater is suitable for the full rated capacity of the unit; the second pump and heater are spares. Lockett supplies everything, complete. Inquiries are invited. *Descriptive bulletins sent on request.*

A. M. LOCKETT & COMPANY, LTD.
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON

YOU CAN CUT PIPING COSTS with CATAWISSA PERFECT SEAL UNIONS

CATAWISSA HOT FORGED STEEL UNIONS priced to compete with better grade malleable iron unions

NEW LOW PRICE! CATAWISSA HOT FORGED STAINLESS STEEL UNIONS

a type for every use! CATAWISSA STAINLESS STEEL UNIONS machined from solid bars

WRITE FOR BULLETIN 10-A

CATAWISSA VALVE & FITTINGS CO.
206 Mill St. • CATAWISSA, PA.

sales engineer, Blodgett has a special assignment in engineering applications for redesigning to welded steel fabrication. Also, R L Hall and Robert Hirsch are assigned as district engineers to Pittsburgh office.

James M Hughes becomes sales promotion manager of Republic Rubber div, **Lee Rubber & Tire Corp,** Youngstown, Ohio.

Westinghouse Electric Corp names Frank L Snyder and C H Bartlett manager and sales manager, respectively, of transformer div in Sharon, Pa. John H Chiles Jr succeeds Snyder as engineering manager of this division.

John P McArthur, now manager, West Coast sales, **Worthington Pump & Machy Corp,** supervises the activities of Los Angeles, San Francisco, Seattle and Salt Lake City district offices. His headquarters are in San Francisco.

Pennsylvania Crusher Co, div of Bath Iron Wks, has made Woodrow W West chief sales engineer. He will be at the main offices of the Crusher div in Philadelphia.

Ozalid div of **General Aniline & Film Corp** opens branch office at 912 12th St, N W, Washington, D. C. Arthur O Woldridge is branch manager in charge.

Purolator Products Inc, Newark, N. J. elects James D Abeles assistant to Ralph R Layte, president of the firm.

Wayne McCarthy is promoted to North Coast regional manager of **Minneapolis-Honeywell Regulator Co.** His headquarters are in Portland, Ore. McCarthy succeeds John B Banks who resigned. Wayne E Petersen replaces McCarthy as Des Moines branch manager.

Election of Wm A Marsteller, Chicago, and Robert P Melius, Milwaukee, as vice-presidents of **Rockwell Mfg Co,** Pittsburgh, has been announced.

H Dale Cook becomes manager of industrial control sales div of **Perfex Corp,** Milwaukee, Wis. Cook replaces Meeg who is no longer with the company. Also, 13 new distributors are appointed in various states as follows: R M Brand Co, Tucson, Ariz., and Albuquerque, N. M., covers those two states and part of Texas; Leekley-Hergenrather & Assoc, Los Angeles—southern California; R A Parker Co, San Francisco—northern California and Nevada; Thermatic Corp, Chicago—nothern counties of Illinois and Indiana; Regulator Controls Co, Indianapolis—southern two-thirds of Indiana; Charles D Jones Co, Kansas City—Kansas and western half of Missouri; Prawl Engrg Corp, Omaha—Nebraska and western part of Iowa; Ohio Pump Service Co, Cleveland—northeastern Ohio.

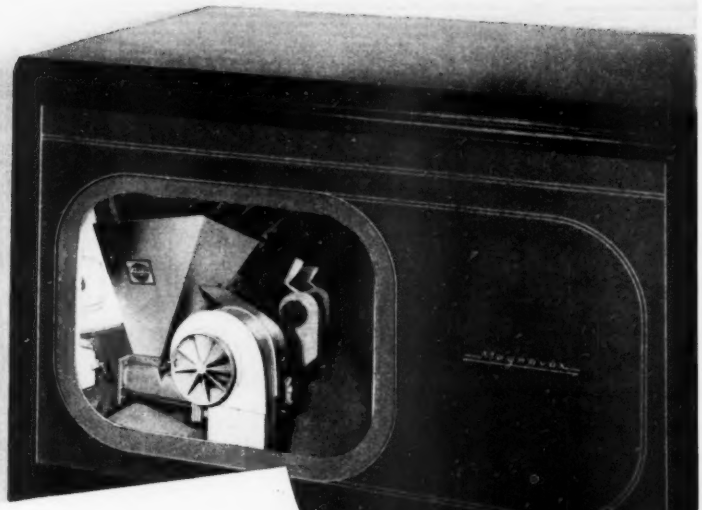
In the East and South, **Perfex** has chosen the following distributors: Harco Distributors Inc, Baltimore—western Maryland and northern tip of Virginia; Patterson Service Sales Co, New York City—New York metropolitan area; Thermotrol Corp, Philadelphia—southern New Jersey, Delaware,

CANTON STOKERS

CANTON STOKERS

GET EXCELLENT RECEPTION AT MAGNAVOX

(3 Cantons at Fort Wayne, Indiana, Plant, 2 at Paducah, Kentucky, Plant.)



The Magnavox Company

Fort Wayne 4, Indiana

Wednesday -
May 11, 1949

Canton Stoker Corp.
Andrew Place S.W.
Canton 1, Ohio

Subject: CANTON Stoker Installation

Gentlemen:

Mr. W. D. Whipple has requested that I forward to you our impressions of the three Heavy Duty CANTON Stokers which were installed sometime ago under our 250 H.P. Boilers. After consulting with our chief engineer, we can both say without reservation, that the CANTON Stokers have been a source of great satisfaction to us and have proved themselves a very fine investment.

We like their Heavy Duty construction and the way they operate day after day without interruption burning all kinds of coal with very little attention.

The steam pressure is held at exactly the point you want it and the operation is fully automatic which results in a very high operating efficiency.

In conclusion we wish to say that we are very glad we bought CANTON Stokers, as the equipment and service has been very satisfactory in every respect.

Very truly yours,

THE MAGNAVOX COMPANY
H. L. Matthias
H. L. Matthias
Plant Superintendent

GET THE MONEY-SAVING FACTS ON THE ONLY STOKER GUARANTEED FIVE YEARS AGAINST DEFECTS AND WEAR

CANTON STOKERS

CANTON STOKER CORPORATION
741 ANDREW PL. S.W., CANTON, O.

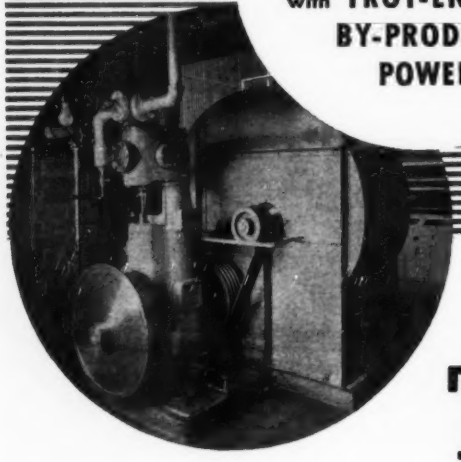
Gentlemen:

☐ Please send all descriptive literature at once.
☐ Have a Canton Stoker Engineer see us immediately.

Name _____
Company _____
Address _____
City _____ State _____

ARE *You* WASTING BOILER HORSEPOWER ?

GET *Maximum* STEAM EFFICIENCY with TROY-ENGBERG BY-PRODUCT POWER



The modern Troy-Engberg Steam Engine is designed to extract the power from the steam you produce before it passes, with little loss in heating value, into your heating or processing cycles. The steam engine acts as a reducing valve but it's a reducing valve that generates power or drives equipment and then exhausts most of the heat units into your processing or heating lines.

The modern Troy-Engberg Steam Engine also offers the following advantages — wide speed range, high overload capacity, high starting torque, conservative speed, exceptional dependability. Investigate this drive for your stokers, fans, pumps, compressors and generators.

TROY ENGINE & MACHINE COMPANY
(Established 1870)
2500 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

eastern shore of Maryland and southeastern Pennsylvania; C B Soper Co, Boston—eastern half of Connecticut and balance of New England; Chet Adams Co, Greensboro—North and South Carolina and most of Virginia.

Ridge Tool Co appoints L C Richardson as sales representative in Missouri, Kansas, Colorado, Arkansas and Wyoming. His headquarters are in St. Louis.

Watson P Hall joins Robert Campbell in the Toronto, Ontario sales office of **American Wheelabrator & Equip Corp.**

A new district sales office of **Babcock & Wilcox Tube Co** as been established at 250 Boylston St, Boston, Mass., under supervision of J W Bramley, manager.

Kellogg div, **American Brake Shoe Co** selects Edward R Anderson, San Francisco, as vice-president of the division. He continues to serve as sales manager of the Pacific district.

A J Rinnander has become a member of **Harnischfeger Corp,** Milwaukee, Wis. He will supervise field activities, Zip-Lift hoist distributors and sales under direction of E W Potratz, manager, Hoist & Trav-Lift Crane div, Milwaukee.

Automatic Control Co announces appointment of A T Timmerman, 759 N Milwaukee St, Milwaukee, Wis, as its new representative for eastern Wisconsin and Michigan peninsula region.

John W Belanger, assistant general manager, apparatus dept, General Electric, has been chosen a director of **Allegheny Ludlum Steel Corp,** Brackenridge, Pa. He succeeded H V Erben, GE vice-president, who resigned.

General Switch Corp names Thomas W Bullock Co, Louisville, Ky., its sales agent for southern Ohio, Kentucky, southern portion of West Virginia and western Tennessee.

Fred H Pillsbury is now vice-president-in-charge of operations for **Century Electric Co,** St. Louis, Mo.

J E White, 1802-1808 S Seventh St, St. Louis, Mo., has been appointed distributor for **Hobart Brothers** and will operate under the name of **Hobart Welder Sales & Service.** Territory includes a number of countries in Missouri and western Illinois.

William S Lowe fills position of executive vice-president of **A P Green Fire Brick Co,** Mexico, Mo.

C A Dunham Co announces following changes in its sales organization: Chicago—W C Zingheim, sales engineer, retires. Under management of George A Mansinger the firm will operate a Chicago sales and service office to serve the metropolitan area and 10 adjoining counties in Illinois; Detroit—W H Baldwin, sales engineer, retires and is succeeded by C C Grubb; Akron, Ohio Grubb is replaced as sales engineer by William W Evans;

control SLIME and ALGAE... SANTOBRITE

Santobrite—Monsanto's Sodium Pentachlorophenate, Technical—offers you these advantages for elimination of slime and algae in cooling water systems:

1. Maximum control of algae and slime-forming organisms.
2. Requires no special feed equipment (merely add to circulating water at any convenient location).
3. Compatible with other chemical treatments given cooling water.
4. Non-corrosive to metals.
5. Easy to apply in powder, briquettes or new dustless pellet form (for those who find Santobrite dust bothersome).
6. Readily available at reasonable cost.

Santobrite provides an economical means of maintaining peak efficiency in your cooling operations... For more detailed information, send for a copy of Monsanto Technical Bulletin O-15. MONSANTO CHEMICAL COMPANY, Desk F, Organic Chemicals Division, 1763 South Second Street, St. Louis 4, Mo.

SANTOSITE...
Controls oxygen corrosion in boiler systems

By removing all traces of residual oxygen, Santosite makes possible economical control of oxygen corrosion in boiler tubes and other steam generating equipment. For detailed information on the Santosite treatment, ask for a copy of Monsanto Technical Bulletin O-26.

Santobrite, Santosite, Reg. U. S. Pat. Off.

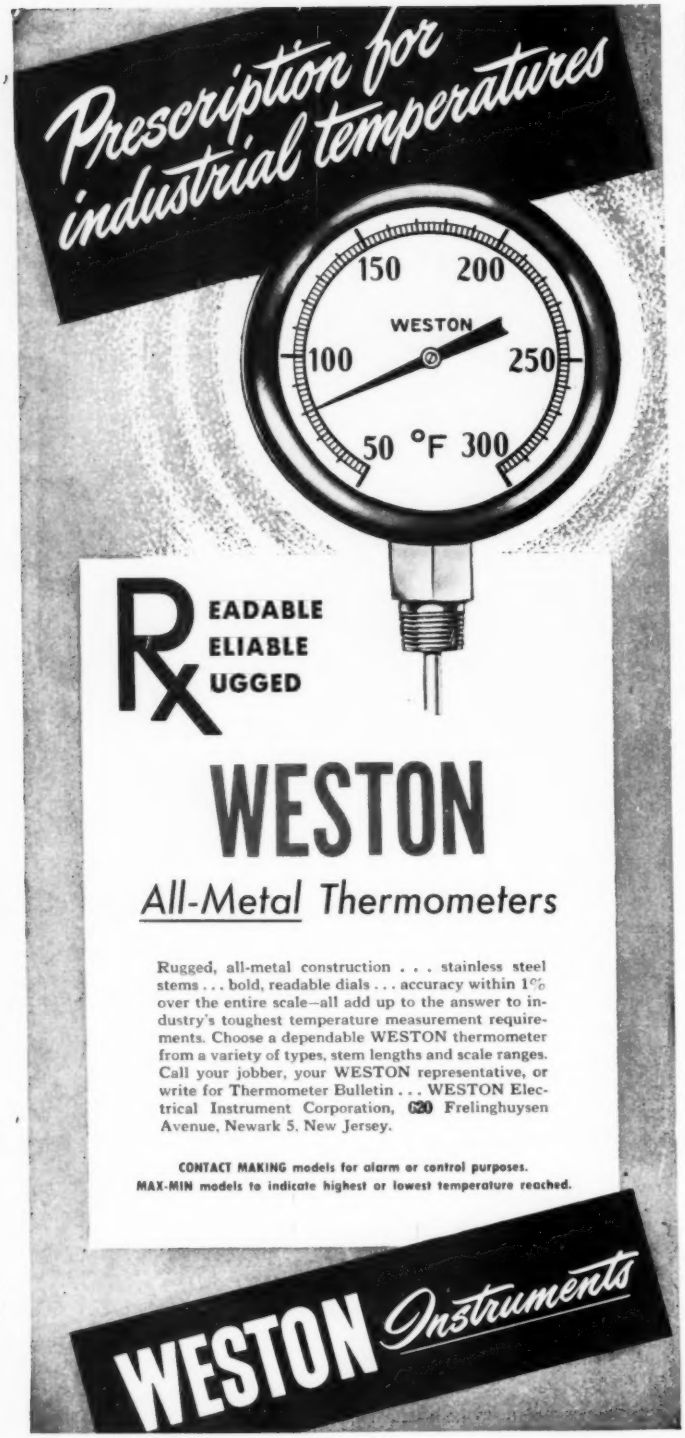
MONSANTO
CHEMICALS — PLASTICS

MONSANTO CHEMICAL COMPANY
Desk F, Organic Chemicals Division
1763 South Second Street, St. Louis 4, Missouri

Please send me: ( ) Technical Bulletin O-15 on Santobrite;
( ) Technical Bulletin O-26 on Santosite for boiler feed water.

Name _____ Title _____
Company _____
Address _____
City _____ State _____

SERVING INDUSTRY...WHICH SERVES MANKIND


Prescription for industrial temperatures
150
200
WESTON
100
250
50 °F 300
Rx
EADABLE
ELIABLE
UGGED
WESTON
All-Metal Thermometers
Rugged, all-metal construction . . . stainless steel stems . . . bold, readable dials . . . accuracy within 1% over the entire scale—all add up to the answer to industry's toughest temperature measurement requirements. Choose a dependable WESTON thermometer from a variety of types, stem lengths and scale ranges. Call your jobber, your WESTON representative, or write for Thermometer Bulletin . . . WESTON Electrical Instrument Corporation, 620 Frelinghuysen Avenue, Newark 5, New Jersey.
CONTACT MAKING models for alarm or control purposes.
MAX-MIN models to indicate highest or lowest temperature reached.
WESTON Instruments

Louisville—David J Rank assumes duties of Wallace Hoeing, sales engineer, retired. Also, sales engineer R K Rouse of Greenville, S. C., establishes an office at Columbia with W M Plowden as local manager.

T W Simmons Jr has been elected vice-president and general manager of **Johnston Pump Co,** Los Angeles, Calif. Kenneth G Lundie has been made general sales manager.

John S Webb and Robert E Wilkinson announce that they have formed an association for practice of engineering under firm name of **Webb & Wilkinson.** Offices are at 177 State St, Boston, Mass.

B E Harris becomes a vice-president of **Ford, Bacon & Davis,** engineers-constructors, of New York, Chicago, Philadelphia and Los Angeles.

New York State Electric & Gas Corp has named Howard E Orton to succeed William H McElwain, manager of Binghamton div. McElwain has resigned to accept an executive position with Metropolitan Edison Co at Reading, Pa. The Binghamton div has been separated into two divisions. Under new plan, Binghamton will incorporate the Triple Cities and Owego areas. The other, Oneonta div, will include the region now within its district and in addition will embrace the Liberty district. Andrew R Ewing has been made manager of Oneonta div. Harold P Allen will continue as manager of Liberty district.

Dr Louis C McCabe rejoins the **Bureau of Mines** as chief of air and stream pollution-prevention research with headquarters in Washington, D. C. He will also serve as assistant chief of fuels and explosives div under Dr A C Fieldner, chief of the division.

British Columbia Electric, Vancouver, B. C., has appointed G Douglas Sauer assistant hydraulic engineer.

Arthur E Focke, research metallurgist, Diamond Chain Co, will be the next president of **American Society for Metals.** Dr Walter E Jominy, staff engineer, Chrysler Corp, will be next vice-president. Both will take office on Oct 19.

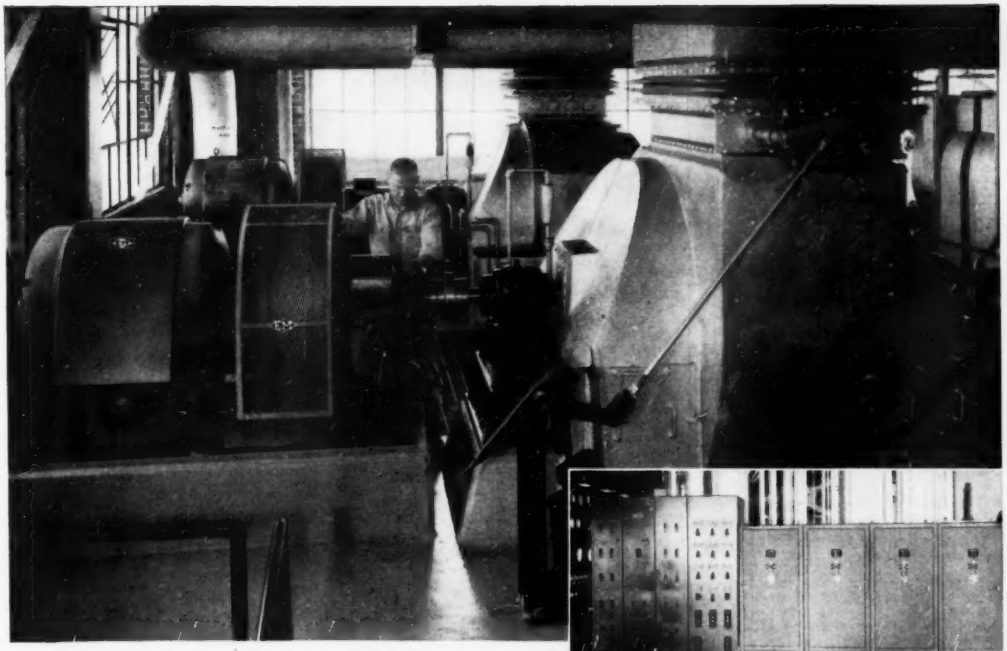
OBITUARIES

Edward J Burnell, 61, vice-president and general sales manager, also a director, of Link-Belt Co, died July 22 at his home in Winnetka, Ill., after an illness of several months.

Charles Hosmer Morse III, vice-president-in-charge of manufacturing, Fairbanks, Morse & Co, died July 9 in a plane crash near Roanoke, Ill.

Arthur Dockter, general superintendent, De Laval Steam Turbine Co, Trenton, N. J., died June 20.

Edward C Newcomb, 76, research engineer in the field of diesel engine development, died July 24 in Boston, Mass.



Above, *left*—The Kansas Power and Light Company Abilene plant installation of two 176 hp, 1170 rpm Magnetic Drives to induced draft fans. The drives are powered by 200 hp, 2200 volt, E-M Drip-Proof Squirrel-Cage Induction Motors. Installation also includes two 76 hp, 176 rpm E-M Magnetic Drives driving forced draft fans and operated by 100 hp, 220 volt E-M Induction Motors of the same type. **Above, *right*—** The four Regutron Controls in the installation.

Stop the biggest loss in boiler plants

WITH ADJUSTABLE-SPEED MAGNETIC DRIVES

The greatest loss in a boiler plant is the result of inefficient combustion. The cause is—too much or too little air; the cure is—better control of boiler draft fans for better combustion.

And so, when The Kansas Power and Light Company selected drives for its boiler draft fans, it chose to reduce combustion loss with the most precise system available—the E-M Adjustable-Speed Magnetic Drive with Regutron Control.

This wide range control of boiler fan speed *not only* increases boiler efficiency and stops fuel waste; *but also* extends the life of the fan by reducing wear and gives additional economies by reducing motor-power consumption through its precision control.

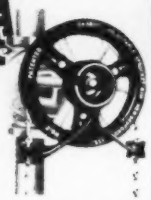
The E-M Magnetic Drive is a torque transmitting device that converts constant-speed drive from the motor into adjustable-speed drive for the fan. The Regutron Control operates to maintain fan speed to within 0.5% of the speed called for by your combustion controls. For the full story of its advantages, call in your nearest E-M sales engineer or write for our Publication 1078.

ELECTRIC MACHINERY MFG. COMPANY
Minneapolis 13, Minnesota

4400-TPA-2087

E-M **ADJUSTABLE-SPEED MAGNETIC DRIVES**

Babbitt
—Adjustable—
SPROCKET RIM
with Chain Guide



INSTANT
POSITIVE
CONTROL

for ALL Overhead Valves

• Pull the chain! That's all that's needed to open or close overhead valves—for complete control from the floor! Operating action of the BABBITT Adjustable Sprocket Rim with Chain Guide is as positive and immediate as that of direct manual control —and 100% safer because the risks of climbing treacherous stepladders, or on benches, machines or boilers is completely eliminated.

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches. Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

KEWANEE

HI-TEST
No 1 WELD

For Power and Process Steam
50 to 180 hp—125 and 150 lbs wp
Designed for easy handling, space saving and unusual economy . . . and built in full conformity with the ASME code for hi-pressure.
For any fuel . . . mechanically or hand-fired. Quickly and easily converted from one fuel to another.
WRITE Department 89-K9
for 6" scale with pipe diameter markings

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Branches in 50 Cities—Eastern District Office: 40 West 40th Street, New York City 18
Division of American Radiator & Standard Sanitary Corporation

SOOT REMOVAL

• You can remove soot from furnace heat transfer surfaces quickly and completely with Nalco SR Chemicals — *while the boiler is on line and in full operation!* You save fuel with clean fire-side conditions; and Nalco SR Chemicals help to keep boilers on line longer, cut maintenance time and materials, and eliminate smoke nuisance while they work . . .

SLAG ALLEVIATION

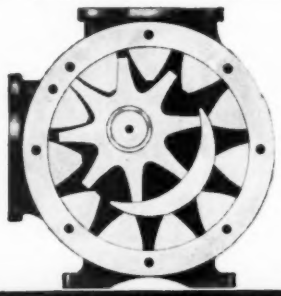
• What is the cost of boiler outage where furnace slagging is a problem? Ask to see whether Nalco SR Chemicals can help you . . . On most slags, Nalco SR Chemicals lower specific gravities to 0.6 — 0.7; make slag spongy and friable so that it falls away or comes off easily . . . Nalco SR-155, a combustion catalyst for oil-fired furnaces, keeps sludge dispersed in tanks and fuel lines; prevents nozzle gumming and clogging and *removes soot.*

Write today for complete data:
NATIONAL ALUMINATE CORPORATION, 6222 W. 66th Place, Chicago 38, Illinois.
Canadian inquiries should be addressed to Alchem, Limited, Burlington, Ontario.

WITH Nalco

SR SERIES CHEMICALS

You can
PUMP IT
with



VIKING ROTARY PUMPS

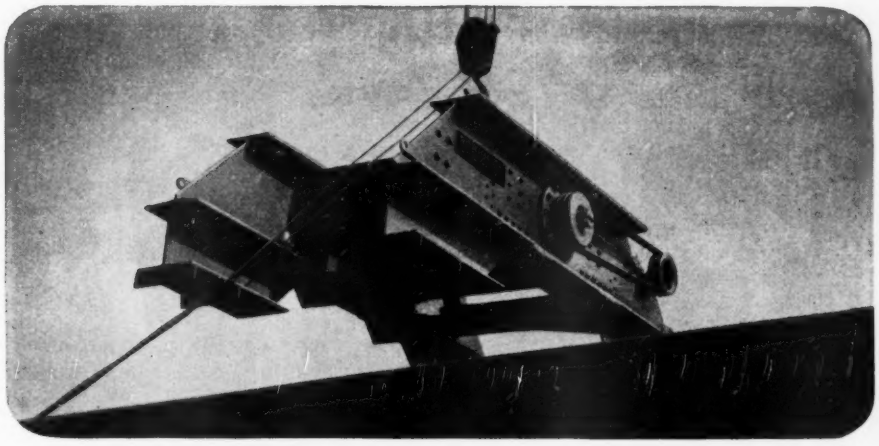
The Pump that moves any clean liquid regardless of viscosity . . . that is the Viking Rotary Pump.
Its "Gear within a Gear—2 moving parts" principle gives you this service. Its rugged construction, without small intricate parts, springs, gadgets, etc. assure long, dependable life.

Viking rotary pumps are engineered for the job . . . to do the work assigned them. *Ask for free folder 49SW today. Recommendations gladly given without obligation.*

See Our Catalog in SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

Here it is... the new Robins GS Car Shakeout



Unloads up to 15 cars a day! Priced low enough for the 2-car-a-day plant!

Now efficient, modern car unloading can be yours *at a cost so low you can no longer afford makeshift methods!*

Hewitt-Robins announces the brand new Robins Model GS Car Shakeout.

The GS Car Shakeout is rugged and powerful, yet designed for the smaller-size plant. It can unload up to *fifteen* cars a day, but it is so economical you can afford to use it for only *two* or *three* cars a day.

Most important, the new Model GS is backed by Hewitt-Robins, originators of the Robins Car Shakeout which has unloaded over 350 million tons of material from hopper-bottom cars.

Get all these advantages introduced by the original Robins Car Shakeout: (1) save time, (2) save labor, (3) save money, (4) reduce demurrage charges, and (5) eliminate danger to workmen.

New design features make the GS Car Shakeout lighter in weight. This means that smaller, lighter and less expensive hoist and supporting structure can be used.

Learn all about the new Model GS Car Shakeout and what "push-button" unloading can mean to you. Send coupon below—*today!*

ROBINS CONVEYORS DIVISION

HEWITT-ROBINS INCORPORATED

ROBINS CAR SHAKEOUTS

MODEL GS—Hewitt-Robins, the originator of the Car Shakeout, now offers TWO models. The new GS is for general service, where car receipts are 15 a day or less.

MODEL HD—The famous Robins Heavy-Duty Car Shakeout for continuous, high-speed unloading. Proved in the unloading of over 350 million tons of material.

Get the story of the new Model GS Robins Car Shakeout now. Mail this coupon today.

ROBINS CONVEYORS DIVISION, Dept. P-9, Hewitt-Robins Incorporated, Passaic, New Jersey

Gentlemen: I want to know about the new Model GS Robins Car Shakeout—fast!

☐ Send me descriptive booklet. ☐ Have a representative call on me.

We unload about _____ cars a day of _____ (material).

NAME _____ TITLE _____

COMPANY _____

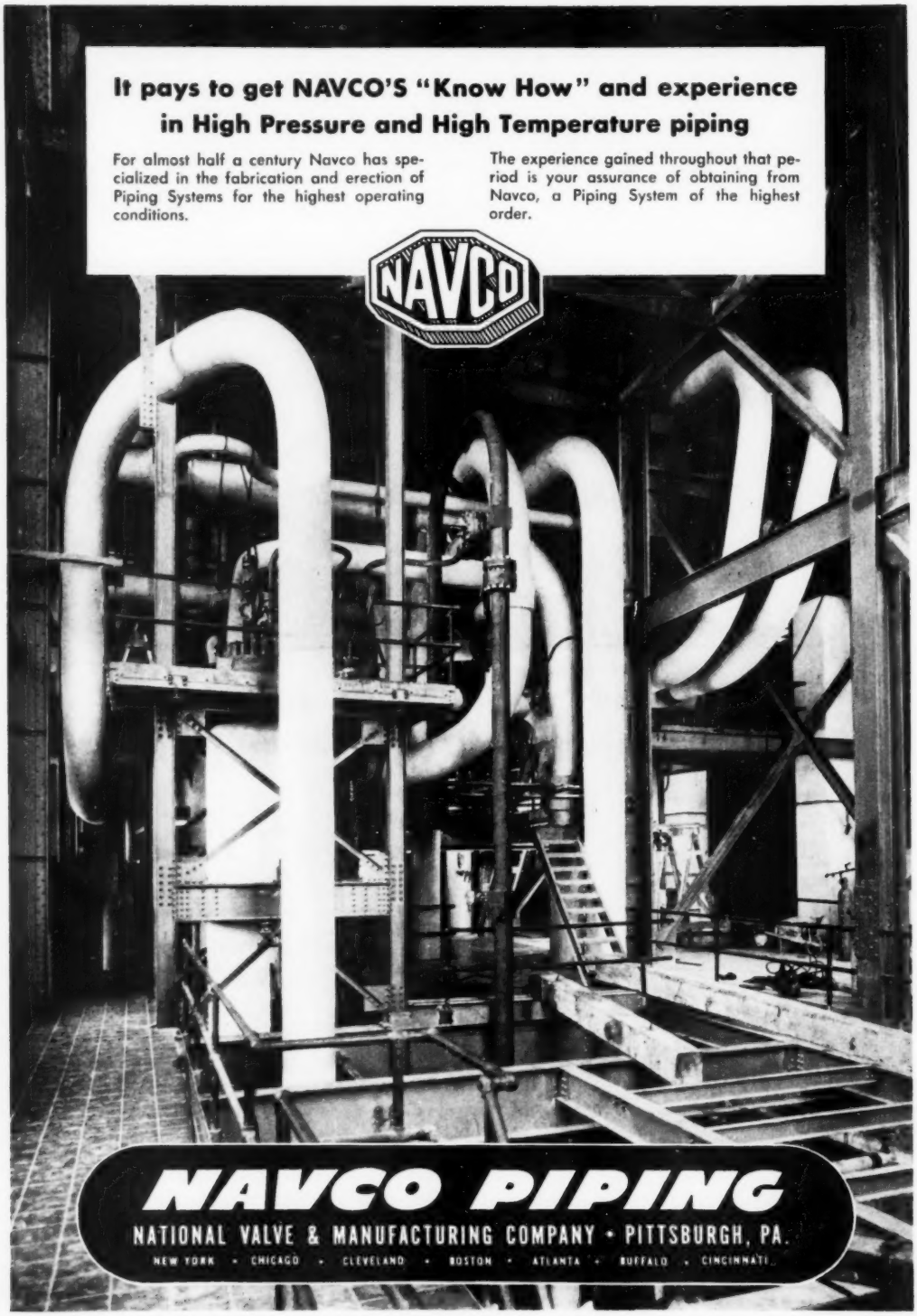
ADDRESS _____

CITY AND STATE _____

It pays to get NAVCO'S "Know How" and experience in High Pressure and High Temperature piping

For almost half a century Navco has specialized in the fabrication and erection of Piping Systems for the highest operating conditions.

The experience gained throughout that period is your assurance of obtaining from Navco, a Piping System of the highest order.


NAVCO
NAVCO PIPING
NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • BUFFALO • CINCINNATI

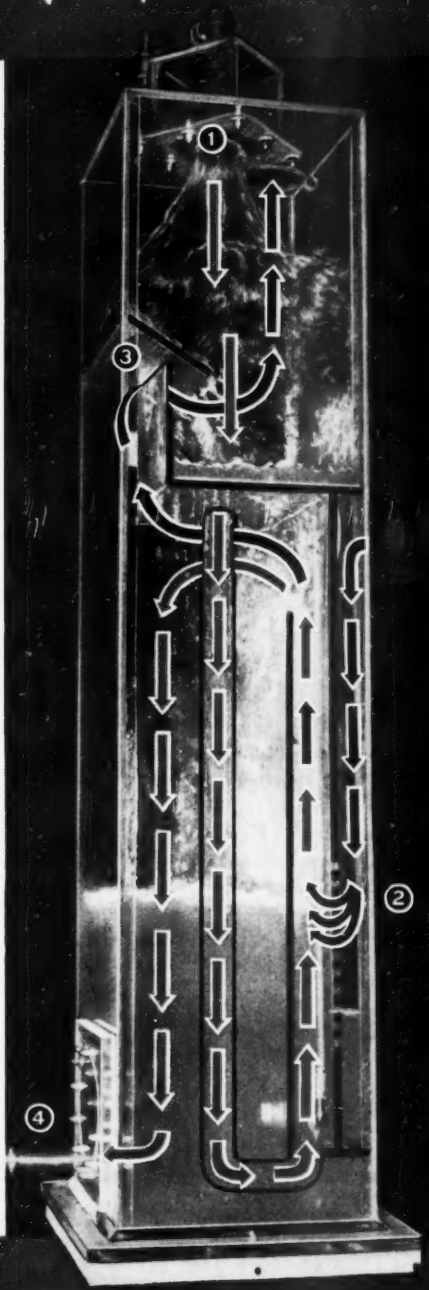
Inside Information

HOW THE PERMUTIT DEAERATOR REMOVES ALL OXYGEN AND CO_2 SO EASILY, EFFICIENTLY!

One look is worth 10,000 words! From this transparent model of the Permutit Deaerating Heater, you can *see* why it provides you with the easiest, most efficient way of deaerating water for boiler-feed make-up.

The Permutit Deaerator recovers waste heat economically, prevents corrosion of feed lines, stage heaters, economizers, and boilers, and is itself corrosion-free. It operates noiselessly and is adaptable to varying steam pressures. Above all, its simplicity of design insures a minimum of expense and attention for maintenance.

Write for full details to The Permutit Company, Dept. P-9, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., Montreal.



1 FIRST STAGE. Cold water, entering here, is heated almost to steam temperature by *spraying* it through steam. This removes 98% of the oxygen. The water then travels downward through the pipe toward the second stage.

2 SECOND STAGE. Here the partially deaerated water is intimately mixed with steam entering through the scrubber. Violent boiling and vigorous scrubbing is assured for both light and heavy loads, and deaeration is completed.

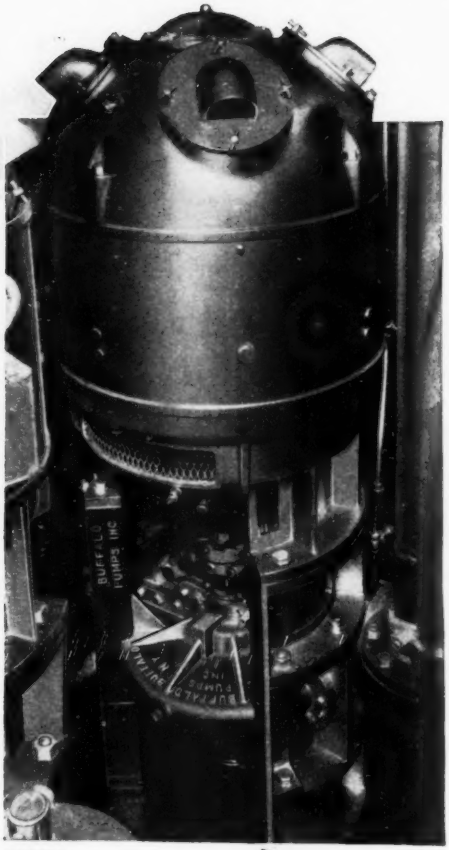
3 The steam from the scrubber travels upward and enters the first stage of the heater, where it partially deaerates incoming water. The remaining steam is then vented to the atmosphere.

4 Here the completely deaerated water settles and may be drawn off. Ample water storage space is provided below the water control level.

Permutit

FOR 35 YEARS WATER CONDITIONING HEADQUARTERS

Cramped Quarters?



THIS PUMP "FITS IN" WHERE HORIZONTAL MODELS WON'T — ONE OF THE WIDE "BUFFALO" LINE

"Buffalo"

FOR ANY CLEAR WATER SERVICE YOU NEED!

● Your installation may not require the "Buffalo" vertical Double Suction Pump above—but whether your space is short or you have some other problem, there's a "Buffalo" Pump TAILOR-MADE for the job!

"Buffalo" Double Suction Pumps are available in capacities from 10 to 10,000 gpm up to 350′ heads. "Buffalo" Class "RR" Single Suction Pumps will handle from 20 to 900 gpm at pressures up to 1500′ head. All are setting performance, endurance and economy records in every branch of industry—in every type of clear water job. Why not have your "Buffalo" representative give you the engineering facts on these durable, dependable pumps?

Write for your free copy of Bulletin 955-N, above, also Bulletin 980-B, on Class "RR" Pumps for clear water service.

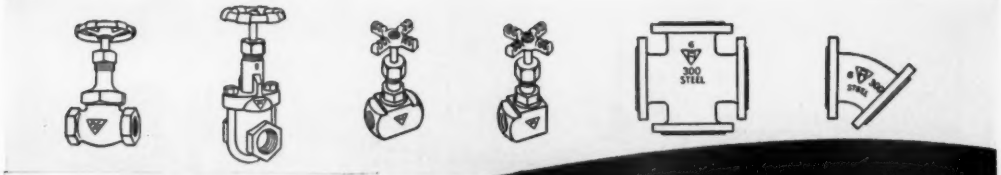
"Buffalo" PUMPS

BUFFALO PUMPS INC.

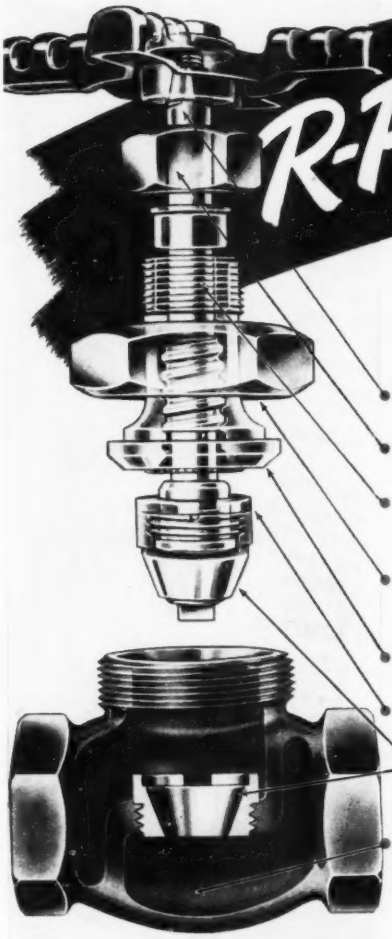
488 BROADWAY BUFFALO, NEW YORK

Canada Pumps Ltd., Kitchener, Ont.

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



R-P & C HEAVY-DUTY BRONZE GLOBE VALVE



FOR TOUGH THROTTLING CONDITIONS

500 BRINELL DISC AND SEAT

- **STEM** high tensile rolled bronze. Large diameter and long thread contact.
- **PACKING NUT** and gland follower of heavy bronze transmit even pressure onto packing.
- **STUFFING BOX** large and deep. Packed with formed rings of braided asbestos, lubricated and graphited. Can be repacked under pressure.
- **UNION NUT** heavy, rugged. Facilitates removal and replacement without danger of distorting body or threads.
- **BEVELED JOINT** permits tighter union between body and bonnet.
- **DISC LOCK-NUT** holds disc securely to end of stem.
- **FULL-PLUG DISC and SEAT RING** stainless steel of 500 Brinell—near diamond—hardness.
- **BODY P & C** High Test Bronze. Reinforcing ribs give added strength. Heavy end hexes with standard, full length threads.

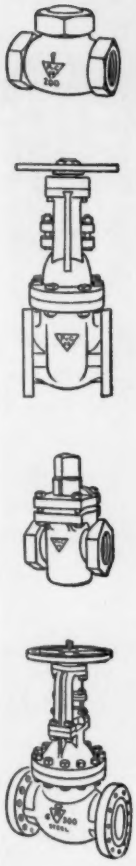


Fig. 531-P
350 lbs. Steam • 1000 lbs. OWG

Send **FOR THIS FOLDER** *which contains a detailed description of this valve. Ask for* **DH-116**

ACCO

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston
New York • Philadelphia • Pittsburgh • San Francisco • Bridgeport, Conn.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

READING-PRATT & CADY VALVES

Inverted bucket in-line trap. To 250 p.s.i. Sizes ½" to 1".

Inverted bucket trap. All stainless fitted. To 250 p.s.i. Sizes ½" to 2½".

Inverted bucket blast trap (thermal air by-pass). Sizes ½" to 1".

Open bucket trap. Semi-steel or cast steel. Sizes ½" to 3".

Ball float trap for draining air line or venting service. To 200 p. s. i.

HERE'S WHY YOU SHOULD BRING YOUR STEAM PROBLEMS TO

STRONG

1. Over 40 years' specialized *engineering experience* in all types of steam problems;

2. Completeness of the STRONG line gives you the added advantage of choosing *exactly* the *right* size and type of steam specialty to meet your *individual* need;

3. Acceptance of STRONG products as *standard* by outstanding engineering firms and large users;

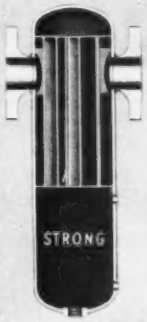
4. Advanced engineering design to maintain *leadership* in the field.

Insist on genuine STRONG steam specialties and repair parts for reduced maintenance and increased production. A large staff of STRONG factory-trained field engineers is at your service. Bring your next steam problem to STRONG*.

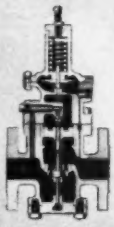
STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street · Cleveland 13, Ohio

*Trade Mark Reg., U. S. Pat. Off.

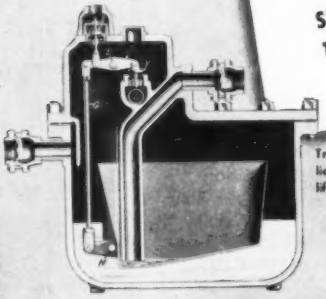
Forged steel inverted bucket trap. To 1,800 p.s.i. Sizes ½" to 2".



Fabricated horizontal or vertical steel separator. Sizes ½" to 10".

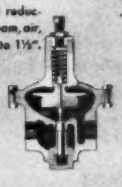


Pilot operated pressure regulator for steam, air, gas. Sizes ½" to 4".



Trap for removing liquids from vacuum or lifting (pumping) service.

Direct operated reducing valve for steam, air, gas. Sizes ¾" to 1½".



Quick cleaning strainer. Semi-steel and cast steel. Sizes ½" to 4".

Block steel valve for continuous blowdown or throttling service.

REG. TRADE MARK

SPECIFY

ANUM-METL Reg. Trade Mark

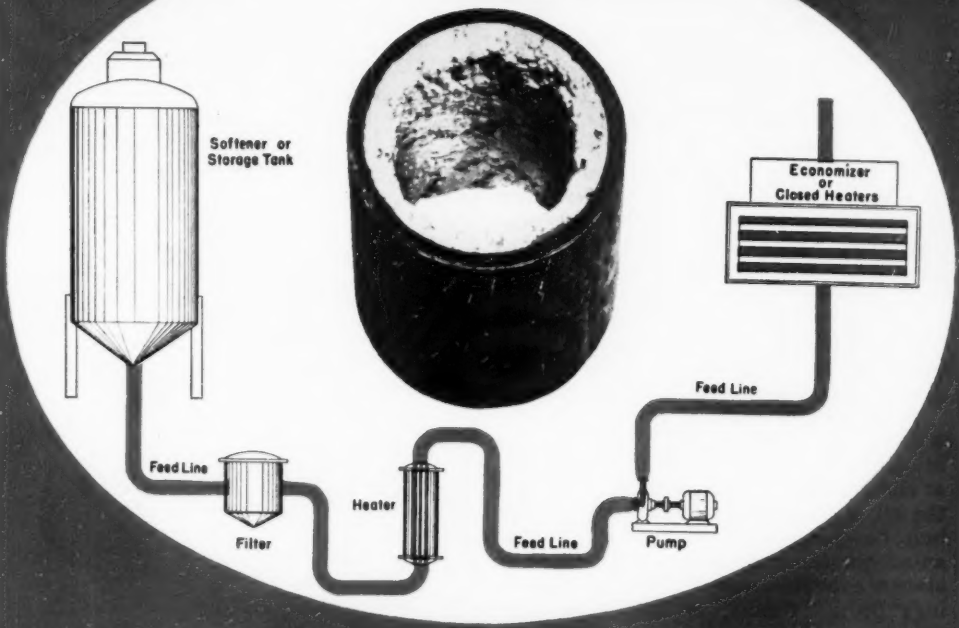
STRONG

STEAM SPECIALTIES

SEND FOR NEW STRONG CATALOG!

Complete, up-to-date specifications and prices on entire Strong line including steam and lifting traps, reducing valves, separators, strainers, continuous blowdown valves, and engine stops. Valuable tips on piping and trap sizing, etc. Write for Catalog 68 today!

PREVENT DEPOSITS IN THE FEEDWATER SYSTEM WITH DREW *Organic* STABILIZERS



Objectionable deposits may occur in the feedwater system because of the adherence of materials that precipitate from the water. The principal causes of precipitation are the effect of heat on hardness and iron, and the effect of boiler water treating chemicals (alkalies and phosphates) on hardness.

Drew Organic Stabilizers prevent deposits in feedlines, economizers, heaters, and other portions of the feedwater system.

Your local Drew engineer is available to discuss all aspects of water treatment and related problems.

POWER DREW CHEMICALS

E.F.DREW & CO. INC.
15 E. 26th ST., NEW YORK 10, N. Y.
Representatives in all key cities

BOILER WATER TREATMENT
COOLING WATER CONDITIONING

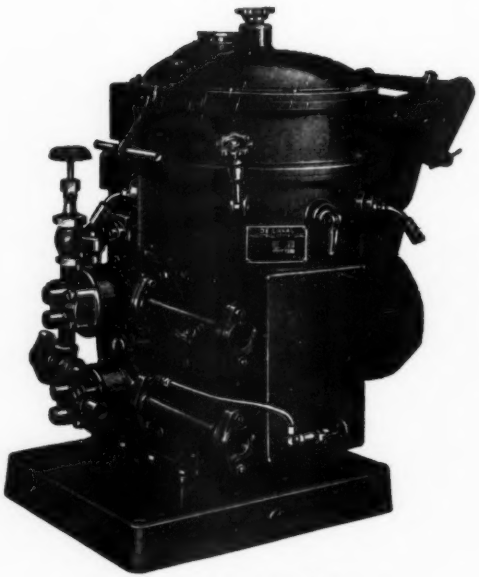
WHEN DO I PAY FOR MYSELF?

"I am De Laval Centrifugal Force. Working in a De Laval Oil Purifier, I nip trouble in the bud. I protect your power unit from impurities in the lubricating system. I may save you more than you can ever determine!"

Bearing trouble — usually synonymous with lubricating trouble — comes at unexpected or inopportune times. When you get a warning, it is too late.

A De Laval Oil Purifier removes by centrifugal force both of the trouble makers in lubricating systems — water and dirt, or sludge. On continuous by-pass, it keeps the oil in a condition so pure that it can best be compared with new oil. Hence an adequate supply of purified lubricant is always available, and the danger of bearings being "frozen" is reduced to the vanishing point.

The number of bearings saved — or the amount of "down time" avoided — is difficult to evaluate precisely in such cases, just as it is impossible to evaluate a lightning rod in a storm. The chances are that many, many times in the course of a year a De Laval serves to avoid serious trouble, or even a complete shutdown of power-generating facilities. In other words, sooner or later your De Laval will pay for itself.



Model 67 "Uni-Matic" Oil Purifier

The "Uni-Matic" is an integral oil purification unit consisting of Oil Purifier, pumps and — when desired — heater. Several sizes available.

De Laval

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

OIL PURIFIERS for more dependable power production

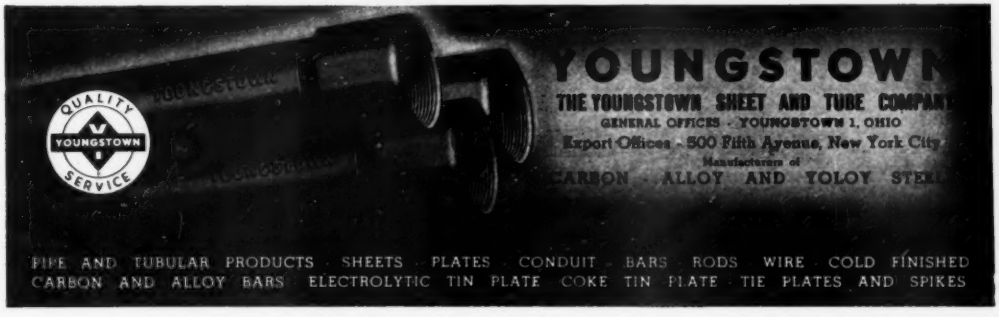
INSTALL STEEL PIPING ADEQUATE FOR TOMORROW'S NEEDS

so school children could drink

IN a certain Ohio city, a bond issue was submitted to the voters for modernizing a school building. The most publicized item of the modernization program was a provision to install a complete new system of drinking fountains. In planning and erecting the building several years ago, those responsible had failed to specify and install steel pipe large enough to insure a free flow of water to the fountains on all floors.

How much cheaper for the taxpayers --and how much healthier for the children--if adequately sized pipe had been installed in the first place! Then, it would have cost only a few cents a foot more; now, it's costing thousands of dollars more to get fountains that work satisfactorily.

Youngstown pipe distributors are prepared to recommend and furnish steel pipe of proper sizes for any job, adequate for tomorrow's needs.


QUALITY
YOUNGSTOWN
SERVICE
YOUNGSTOWN
THE YOUNGSTOWN SHEET AND TUBE COMPANY
GENERAL OFFICES · YOUNGSTOWN 1, OHIO
Export Offices · 500 Fifth Avenue, New York City
Manufacturers of
CARBON · ALLOY AND YOLOY STEEL
PIPE AND TUBULAR PRODUCTS · SHEETS · PLATES · CONDUIT · BARS · RODS · WIRE · COLD FINISHED
CARBON AND ALLOY BARS · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · TIE PLATES AND SPIKES

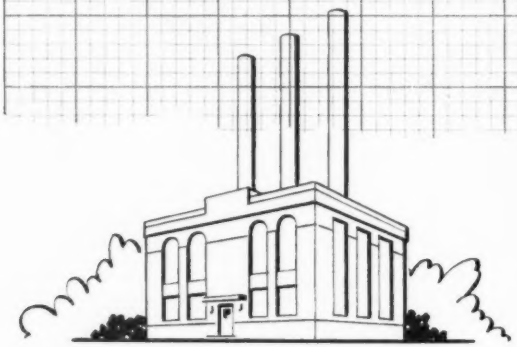
HYDRAULIC
AUTOMATIC MANUAL
GOLDEN-ANDERSON
POSITIVE CONTROL
Check Valves

DEPENDABILITY

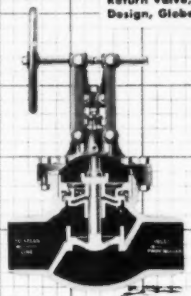
proven

in the **POWER PLANTS**

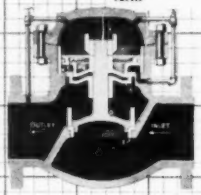
of America



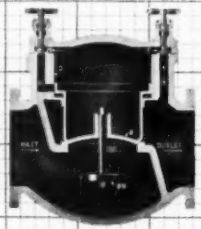
G-A Single Acting Non-Return Valve, Toggle Yoke Design, Globe Pattern.



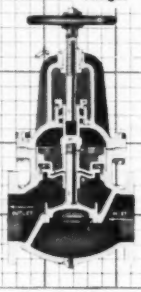
G-A Automatic Hydraulic Check Valve, Globe Pattern.



G-A Double Cushioned Check Valve, Globe Pattern.



G-A Combined Throttle and Automatic Engine Stop Valve, Standard Yoke Design.



Years of long, hard usage is the absolute test for any Industrial or Power Plant equipment. Since 1905 Golden-Anderson Valves have earned a reputation for quality and dependability by giving *satisfaction plus* and safety in the toughest applications.

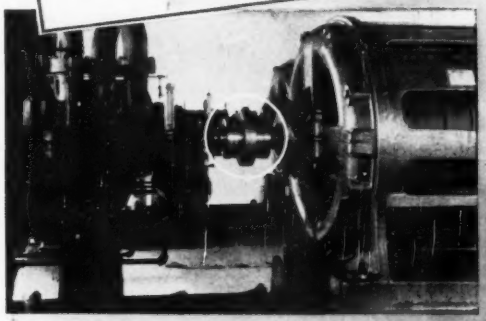
Golden-Anderson "Positive Control" Check Valves eliminate surge and water hammer on emergency shutdowns . . . prevent pump or motor reversing by closing instantly before back flow can start. Write today for complete, technical data.

GOLDEN-ANDERSON
Valve SPECIALTY COMPANY
Keenan Building, Pittsburgh 22, Pa.

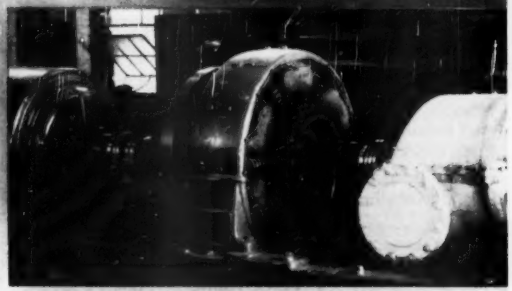
LIFE AND PROPERTY PROTECTION
VALVES SINCE 1905

How Fast's Exclusive Metal to Metal Seal *Boosts* Your Plant's Production

Correctly engineered oil-protecting "rocking bearing" allows freedom of movement to compensate for misalignment because spherical base has same axis as hub spline faces!



OIL REFINERIES insist on **Fast's Couplings** to *keep* their vital machinery *running*, because they know **Fast's** virtually *eliminate* all shutdowns due to coupling failure! This Coupling has been in service since 1931.



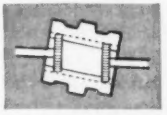
POWER PLANTS use **Fast's Couplings** because metal-to-metal seal, absence of perishable parts, virtually eliminate shutdowns!

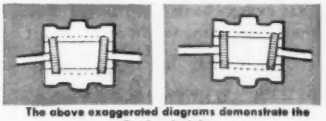
YOUR production figures *go up* and *stay up* when your vital equipment is protected with **Fast's Couplings**, because **Fast's** virtually eliminate all shutdowns due to coupling failure. **Fast's** use no perishable parts or packing rings . . . they are the *original* gear-type coupling that *really* guards load-carrying oil from moisture, abrasive dust and grit! **Fast's** have *exclusive* "rocking bearing" principle that gives *sure* metal-to-metal seal.

When you specify **Fast's** you get years of top engineering experience, Koppers' high standard of workmanship, and unexcelled coupling service including available parts if required by change of drive, *even if your Fast's have been running for 30 years*. You save money, eliminate bottlenecks with **Fast's** on the job, because machine and motor life is prolonged, upkeep costs are cut, shutdown losses reduced. Find out about **Fast's**! Use the handy coupon, or write today for free catalog. Address: Koppers Co., Inc., **Fast's** Coupling Dept., 249 Scott Street, Baltimore 3, Maryland.

FAST'S COUPLINGS COMPENSATE FOR ALL MISALIGNMENT

The floating sleeve takes a neutral position. All forms of misalignment are compensated for between the lubricated faces of the splines, equally divided between the driving and driven members. The entire assembly revolves as one unit.





The above exaggerated diagrams demonstrate the Fast's principle.

KOPPERS **FAST'S** *Self Aligning* **COUPLINGS**

MAIL COUPON FOR FREE CATALOG!

KOPPERS CO., INC., FAST'S COUPLING DEPT.,
249 Scott Street, Baltimore 3, Md.

Please send me your new **Fast's** Coupling catalog which contains all the facts and specifications.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

the HARD WAY

to solve your water conditioning problem —

Consider these factors: *Source of water*: Degree of hardness, alkalinity, turbidity, mineral and organic impurities, sludge forming characteristics, corrosiveness, seasonal variations, temperature ranges, etc. *Results required*: Degree of clarity, softness, alkalinity, residuals, stabilization, purity, taste and odor correction, iron removal, corrosion control, blended water, etc. *Method of treatment*: Water softener, chemical feed, concentration control, aeration, filtration, deconcentration, oil removal, pre-treatment, post-treatment, dealkalization, combination system, modernization of existing equipment, investment cost, etc. *Operating factors:* Cost, savings versus investment, operating skill required, critical limitations, plant balance, load factors, operating ranges, space requirements, etc.

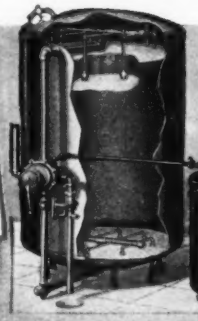
and the EASY WAY: *call on* ELGIN!

We show above just a partial listing of the factors that often must be considered in solving a water conditioning problem. Our purpose is not to worry you with complexities, but to show you how unsound it is to entrust your water conditioning problem to an organization that is limited in experience and in scope of methods and equipment.

Naturally if the organization is limited to zeolite softeners, the solution proposed to your problem will be zeolite softeners . . . if limited to chemical treatments, the proposed solution will be chemical treatments . . . and so on down the list.

On the other hand, Elgin (utilizing all authoritative methods) is bound to no method but the *BEST*. For example, the most spectacular of all Elgin achievements is the dollar-saving Elgin "Double-Check" Softener described opposite . . . yet . . . you can't buy it unless an analysis of your condition convinces us that it is both the best and most economical solution of your water conditioning problem! And this holds true for every product in the Elgin line.

Yes, through Elgin you get the counsel of a firm that has seen enough conditions to *recognize* your needs; the counsel of a firm that is in a position to apply the method that exactly *suits* your needs. For a complete check-up of your requirements there is no cost or obligation whatever.



ELGIN "Double-Check" WATER SOFTENER

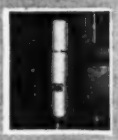
By preventing loss of zeolite the "Double-Check" design of the Elgin Softener permits a far larger bed of zeolite and utilizes it more efficiently. Result: 44% more soft water per regeneration than other softeners of same size using same type zeolite. "Double-Check" principle is also adaptable (at low cost) to your present softener of any make.

FILTERS — PURIFIERS

Elgin Water Filters and Purifiers for any filtration or purification requirement. Pressure Filters, with quartz or non-siliceous filtering medium, remove suspended impurities, including iron in suspension. Taste and Odor Removal Filters remove bad tastes and odors, including chlorine.

CHEMICAL FEED SYSTEMS

Many water conditioning problems are best and most economically solved by feeding the right chemical treatment in the right way. Elgin chemical treatments, individually formulated to meet specific conditions and properly fed by dependable Elgin chemical feeders, may prove to be the best answer to your needs.



DECONCENTRATORS

The Elgin Deconcentrator keeps boiler water clean—rids boiler of sludge, mud, and scale-forming matter — eliminates wasteful blowdown—cuts water treatment costs. Impurities are trapped in sedimentation chamber and eliminated in concentrated form.

ELGIN SOFTENER CORPORATION

130 North Grove Avenue

Elgin, Illinois

ELGIN ECONOMICAL WATER CONDITIONING

ASK FOR
NEW BULLETIN 610
"ELGIN WATER CONDITIONING"
GIVING FACTS YOU NEED.

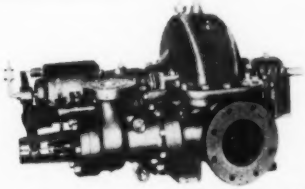
SOFTENERS • CHEMICAL TREATMENT • FILTERS • BOILER WATER CONDITIONING

5 Ways

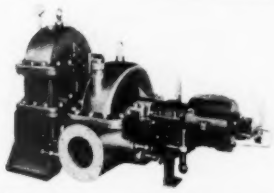
TO MAKE YOUR STEAM DO MORE WORK...

Power-Saving Worthington Turbines Cut The Operating Costs Of Mechanical Drives

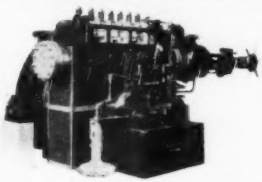
Worthington Turbines are built in all sizes and types — including straight condensing, straight non-condensing, extraction, mixed pressure extraction, low pressure and high back pressure — to meet the widest range of requirements. Steam or gas driven, for mechanical or generator drive, all are available with governors for constant or variable speeds. If desired, control devices can be incorporated in the governor.



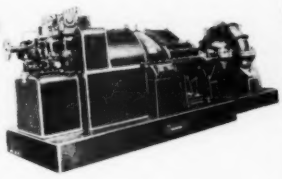
Single Stage. Sizes up to 1500 hp. Particularly adapted for driving all types of pumps, fans, small blowers and other auxiliaries where simplicity of construction and reliability are of prime importance.



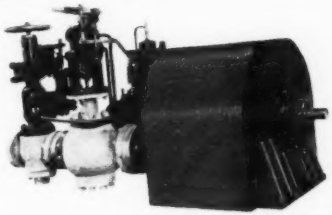
Single Stage With Integral Reduction Gear. Sizes up to 200 hp. A compact, sturdy, dependable unit with economical turbine operation. Especially suited for driving slow or moderate speed auxiliaries at low steam consumption.



Multi-Stage. Sizes up to 20,000 hp, and all types. Longer blade-life and more economical than single stage turbines especially on larger horsepowers and at slow or moderate speeds. Suitable for all kinds of pumps, blowers, compressors and other mechanical drives.



Multi-Stage With Separate Gear. Like all Worthington Multi-Stage Turbines, these are available in all types and are readily adaptable to special applications. Recommended for driving low speed equipment such as condenser circulating pumps, water supply pumps, etc.



High Back Pressure. Can be supplied in either single or multi-stage type for exhaust pressures up to 250 lbs.

For Low-Cost, Dependable Power. Check fully on the many advantages of Worthington Turbines. You'll discover what users the world over already know — that *there's more worth in Worthington.* Contact your nearest Worthington representative or district office, or write direct to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.*

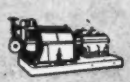
WORTHINGTON

STEAM TURBINES

TS-5

A GREAT TEAM IN STEAM

Feed Water Heaters



Multi-Stage Turbines

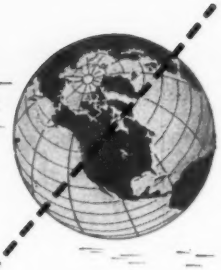
Boiler Feed Pumps

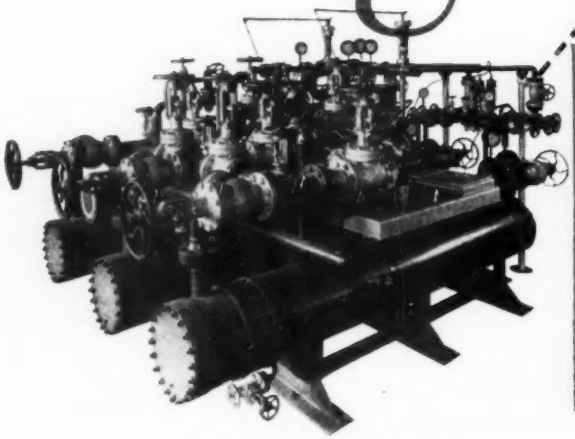
Turbine-Generator Sets

Single-Stage Turbines

Surface Condensers

World's Largest





PREFABRICATED

PUMPING AND HEATING UNIT

.....*"tailor made" by*

ENCO

This 150 gpm fuel oil pumping and heating unit—the biggest ever built—was engineered and built by Enco for a large steel corporation. One motor and two turbine driven pumps, cross connected with three heaters, furnish fuel oil at desired temperature, pressure, and volume to three boilers producing well over 1,000,000 lbs. of steam per hour. One pump and one heater are always available as spares.

The design and performance of all Enco fuel oil pumping and heating systems from the smallest to the largest ever built provide tangible proof of Enco's skill in the field of pre-combustion preparation of fuel oils. Write for bulletin O B-37 or see your local Enco Representative for details on Enco oil burning, pumping and heating equipment to fit *every* boiler room requirement.

EC-475

THE ENGINEER COMPANY

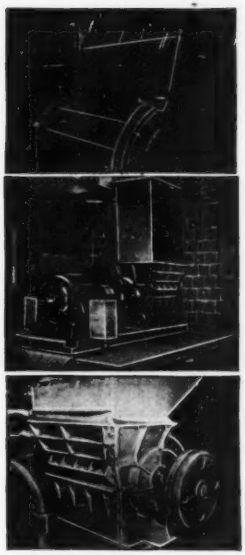
75 WEST STREET, NEW YORK 6, NEW YORK

Canadian Representative: F. J. Ruskin, Ltd.
4220 Iberville St., Montreal 34, P.Q.

10 PLUS FEATURES
That Highlight ENCO'S Superiority

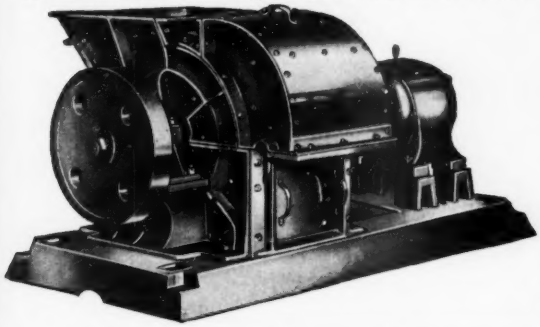
- COMPLETELY AUTOMATIC OPERATION is assured by automatic temperature and pressure regulation valves.
- COORDINATED DESIGN SAVES SPACE. All equipment essential to the preparation of fuel oil for combustion is contained in one compact unit.
- INDIVIDUALLY DESIGNED to meet the specific needs of the particular power plant in accordance with its exact operating requirements.
- ALL PARTS VISIBLE AND ACCESSIBLE for easy operation, maintenance and repair.
- PUMPS AND HEATERS are interconnected to provide maximum flexibility of operation.
- SAFETY VALVES protect individual parts where required.
- EASIER MAINTENANCE – LESS SERVICE-TIME FOR CLEANING because straight tube, multi-pass heaters with removable heads are used.
- PUMPS OPERATE AT MODERATE SPEED. Heaters designed to give the correct viscosity and velocity without fouling.
- SMOOTHER FLOW OF CLEAN FUEL TO FURNACE. Air chamber for each piston pump prevents pulsations – pressure regulator for rotary pumps. Twin type strainers provided to keep atomizer tips from clogging.
- CLEANER BOILER ROOM . . . all overflows connected to a common outlet; flanged drip pan catches oil drip.

YOUR FIRST STEP toward GREATER COMBUSTION EFFICIENCY...



AMERICAN *Rolling Ring* CRUSHERS

Uniform *High* Tonnage Reduction — at *Low* Operating Cost!



American Type "S" Rolling Ring Crusher, with heavy cast steel housing and sectional construction, secured at dust-tight, machined joints with coupling bolts for easy access to crushing chamber.

Custom-built for power plants, American Type "S" Crushers offer 9 different sizes, with capacities from 25 to 500 TPH.

To hit highest operating efficiency, coal firing depends upon uniform sizing . . . one reason it pays to include American Crushers in your expansion and change-over plans. The exclusive shredder ring action of Americans—*through splitting instead of crushing coal*—gives a dependable uniform product with controlled fines—assures a loose, uniform firebed quickly responsive to sudden steam demands . . . without excessive ashpit drop or unnecessary CO_2.

The minimum headroom requirements and independence from auxiliary crushing permit easy, economical installation of Americans without extensive alterations. Heavy cast steel housing and manganese steel shredder rings assure long, trouble-free service.

Send for your copy of "Crushing Coal for Less than 1¢ per ton"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

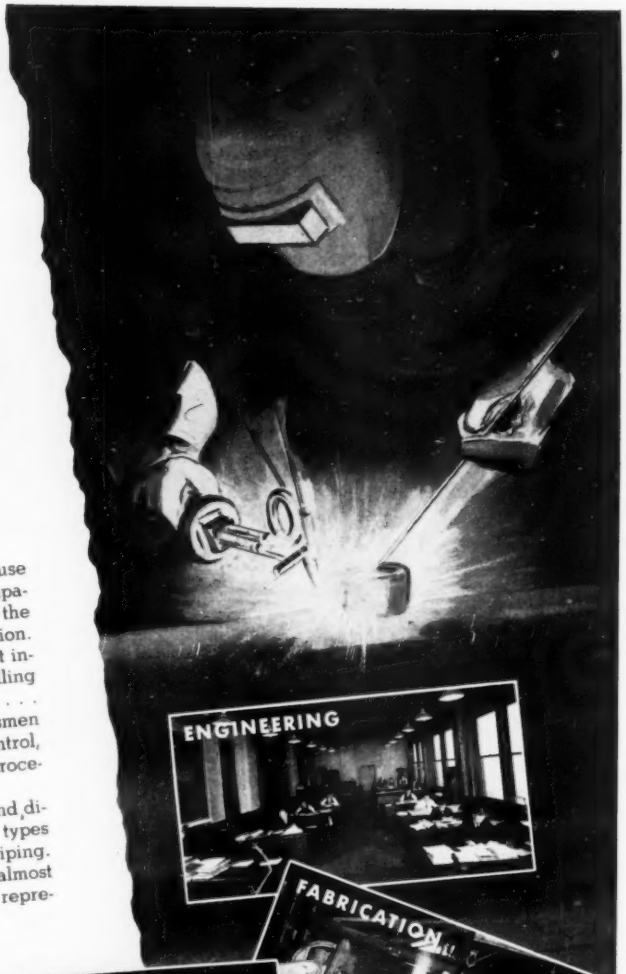
PUT YOUR COMPLETE POWER PIPING JOB IN

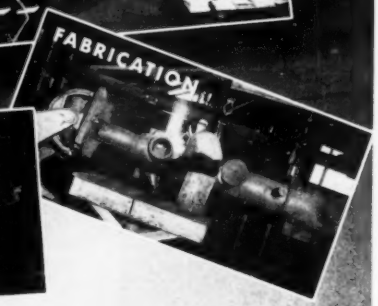
CAPABLE HANDS

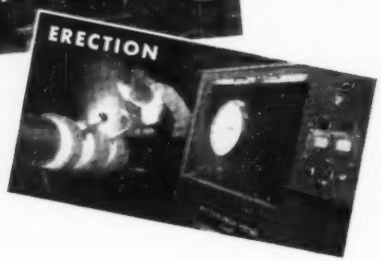
Prefabrication is the accepted method to use on today's power piping job. And it takes capable hands to do the job—every step along the way from engineering through field erection.

Efficient prefabrication requires correct interpretation of blueprints . . . careful detailing to coordinate shop work with field work . . . complete shop facilities and trained craftsmen . . . highly specialized metallurgical control, model testing, and other accepted test procedures . . . and expert field erection.

Equally important—it requires long and diversified practical experience with all types of high pressure, high temperature piping. We have specialized in this field for almost half a century. Ask our nearest field representative for additional information.







Pittsburgh Piping

AND EQUIPMENT COMPANY

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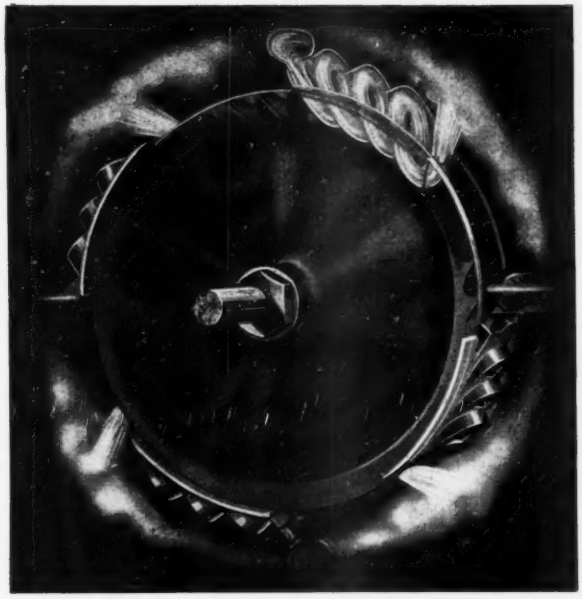
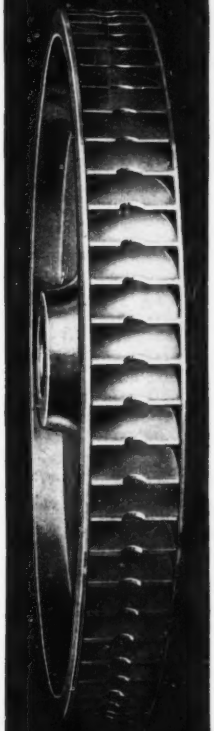
TERRY





BLADE PROTECTION

Made Possible by Nozzle Location

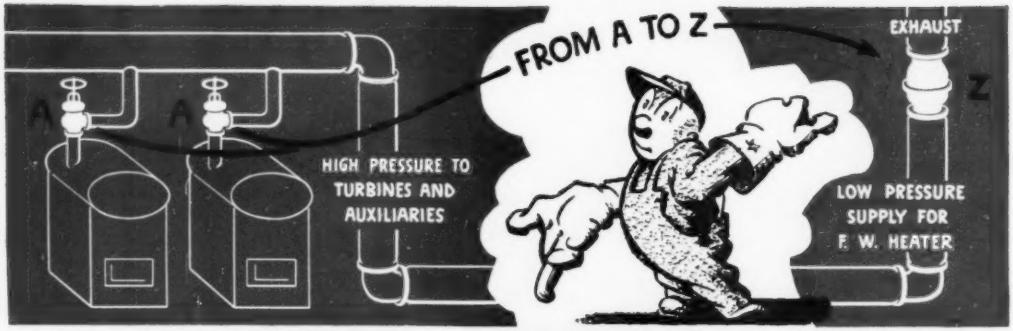
In the Terry Solid-Wheel Turbine, the steam enters the buckets from the top, not from the side of the wheel, as shown in the illustration above. This permits a one inch clearance on either side of the wheel. In addition, projecting rims on each side of the buckets prevent damage to the blades even though excessive thrust should tend to move the shaft.

This feature and others, as important, are described in detail in Bulletin S 116 which will be sent to you on request.

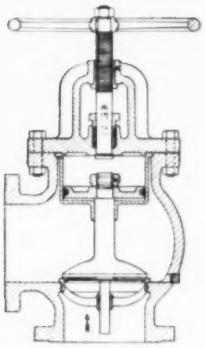
T-1175

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

SAVE MONEY IN YOUR PLANT



—with FOSTER AUTOMATIC VALVES



FOSTER AUTOMATIC NON-RETURN Stop and Check Valve, Type 2

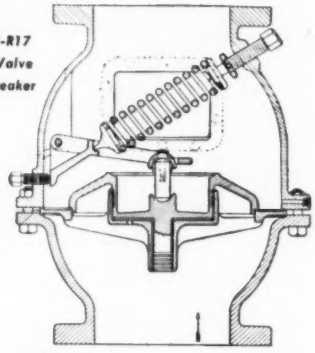
A . . . On your boiler drums, Foster Automatic Non-Return, Stop and Check Valves save money by doing their job perfectly—with the absolute minimum of attention—for years. It is not unusual to find these valves still giving good service after 25 or 30 years and more. Today's valves are even better.

There's nothing skimpy about a Foster Type 2. Full pipe area means negligible pressure drop across the valve. Heavy duty, through bolted construction makes it safe to work under when the boiler is down. Low pressure types to 250 lbs. (stocked) have semi-steel bodies, bronze trimmed, with stainless steel seat rings; high pressure types to 1,500 lbs. have cast steel bodies, trimmed with special heat resisting, corrosion resisting alloys. Piston chambers are renewable. They're built for lifetime service. Globe, angle, or elbow, from 2½" to 12".

Z . . . The R-17 Back Pressure Valve saves money by keeping the pressure where you want it on the exhaust side—for your feed water heater or other low pressure equipment—with a minimum of maintenance. Large pipe area, and large valve area mean low pressure drop across the valve, and sensitive action at low pressures. Saves make-up steam. Adjustable in ounces.

The R-17 has no outside stuffing boxes or external weights. Loading spring is on the atmosphere side of the valve and is accessible for inspection through a large handhole. Renewable seat ring and dash pot. 2½" to 20", (with sizes from 4" to 12" stocked).

Foster Type 34-R17 Back Pressure Valve and Vacuum Breaker



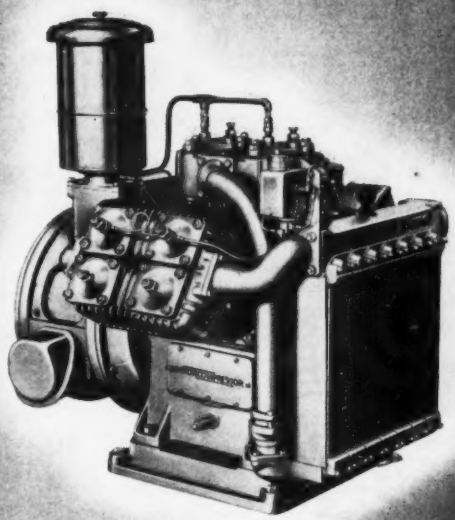
. . . All along the line—Foster Pressure Regulators, Temperature Regulators, Pump Governors, Float Valves, Safety Valves, Check Valves, Relief Valves and Safety Valves are designed and built to save money, by giving reliable, trouble free regulation with a minimum of maintenance. When you select the proper Foster Valve and install it correctly, you are making a sound investment, backed by more than 70 years of practical experience in building good valves, and our reputation for service.

FOSTER ENGINEERING Company

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . AUTOMATIC STOP AND CHECK VALVES . . . ALTITUDE VALVES . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN VALVES . . . VACUUM REGULATORS OR BREAKERS . . . STRAINERS . . . SAFETY VALVES . . . SIRENS

835 LEHIGH AVENUE • UNION, N. J.

WHY THEY LIKE THE MOTORCOMPRESSOR



WHAT IS A MOTORCOMPRESSOR?

An Ingersoll-Rand two-stage, air-cooled compressor with a built-in motor . . . made in five sizes from 25 to 75-hp

WHAT IS IT FOR?

Compressing air to pressures up to 125 psi. It is ideal for main air supply . . . or for supplementing the capacity of larger compressors during peak loads . . . or for locations remote from main compressed-air lines . . . or wherever the advantages of air-cooling are important.

WHO LIKES IT?

Maintenance men, engineers, owners, and workers who rely upon a steady supply of Air Power . . . in mills, factories, mines, railroad yards, foundries, construction jobs, and aboard ship.

WHY THEY LIKE IT?

- Air-cooling eliminates the cost of water, water piping, and the danger of freezing.
- Two-stage compression saves power.
- Channel Valves are durable, efficient, stay tight.
- No need for special foundation.
- Compact and lightweight . . . easy to install or relocate.
- Timken tapered-roller main bearings.
- Constant-level lubrication is simple and trouble-free.
- Dual Control provides efficient regulation under any kind of load . . . a selector switch permits use of either constant-speed or automatic-start-and-stop control.
- Dependable in operation . . . easy to service and maintain.
- Built by Ingersoll-Rand . . . by the men who know Air Power, and who build both the compressors that generate it and the tools that use it.

AIR POWER *The Key to Lower Production Costs*

1-980

Ingersoll-Rand

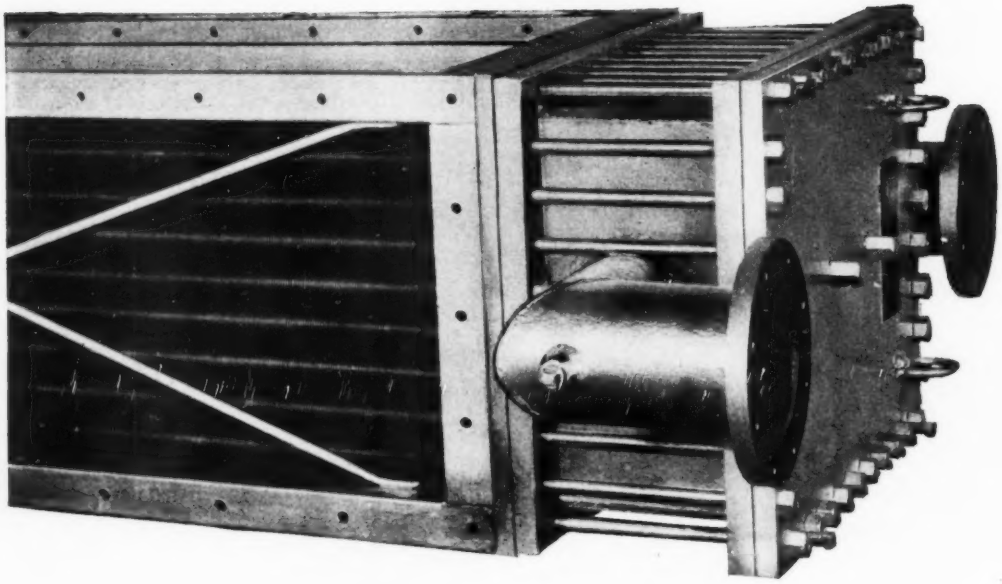
11 Broadway, New York 4, N. Y.

COMPRESSORS • AIR TOOLS • CONDENSERS • CENTRIFUGAL PUMPS • ROCK DRILLS • OIL ENGINES

G-R K-FIN

AIR and GAS COOLERS and HEATERS

Compact and Efficient



G-R K-Fin Units are admirably suited for air and gas cooling and heating duties. The use of K-Fin Elements with mechanically bonded helical fins, requiring no tinning, enables these units to withstand high temperatures and to operate successfully on duties where loosening of fins cannot be tolerated.

One of the distinctive features of the G-R K-Fin Cooler is its cooling surface of superior effectiveness. The K-Fin elements of this unit have helical fins. These fins, forming an extended outside tube surface, provide a higher heat transfer rate for a given air or gas pressure drop than is obtainable with other finned tube coolers.

When used as a *generator air cooler*, the K-Fin unit is embodied in a self-contained, closed, dust-proof and fireproof system, using turbine condensate or other available water supply as the cooling medium.

Some of the many other applications of this unit are for recovering gases from solvents, dehydrating illuminating gas, cooling gases from annealing ovens, and other gas cooling services.

Write for Bulletin 1219 describing all the features of the K-Fin Air and Gas Cooler.

GR-214

THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y.

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

You're sure to have *Better, Safer* boiler water level supervision with Reliance EYE-HYE

Remote Indication Saves Time—Increases Efficiency

YOU SAVE precious seconds—often many dollars—by reading boiler water levels in the EYE-HYE, without tedious dangerous climbing to high boiler gages. An EYE-HYE for each boiler, mounted on your panel board, gets a glance every time instruments are checked—a sure way to catch wasteful or hazardous feed water conditions.

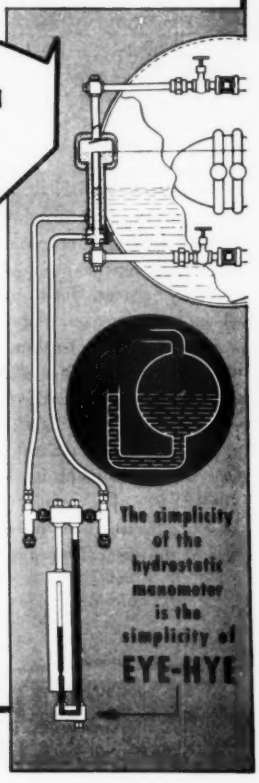
Brightly illuminated green fluid arrests every operator's eye. EYE-HYE's accuracy and dependability resulting from its simple hydrostatic principle and rugged construction are praised by thousands of engineers. It can't be tampered with in service; easy to install; practically no maintenance. Write or call your nearest Reliance Representative.

Reliance UNITEMP—complete temperature equalizing unit—furnished with each EYE-HYE

UNITEMP maintains an even temperature in both hydrostatic legs, thus assuring EYE-HYE's accuracy. It's furnished as original equipment with each EYE-HYE—a *complete unit*, ready to install with small expense for fittings.

EYE-HYEs for all types of service

EYE-HYE models cover all pressure situations, from lowest (even at vacuum) to as high as 2500 psi. Checking levels in auxiliary vessels such as feed water heaters and surge tanks is made faster and more convenient by models especially adapted to that purpose, with graduated face plates if you want them. One EYE-HYE model measures liquid level variations as large as *12 feet*.



BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

We carry your water conditioning job a step further

The efficiency and economy of any water conditioning installation depends, to a great extent, upon the design of the equipment. But to make certain that the design will be right for *your* requirements . . . we, at Graver, carry the job a step further.

PRELIMINARY ANALYSIS — Your raw water supply is thoroughly investigated and the results form the basis for all future calculations. A sample of your water supply, sent to our laboratories now, will get your job started. There is no obligation.

SURVEYS — The requirements for your conditioned water are thoroughly studied, together with the advantages of the several types of equipment which may accomplish the job. The one type which offers maximum efficiency at minimum cost is recommended.

CERTIFIED FINAL ANALYSIS — Before design work is started we will furnish a certified final analysis of the treated water, the conditions of which must be met or exceeded by the completed installation.

ERECTION—Competent field erection crews are available for the installation of your Graver equipment. These crews are your assurance of a job well done in this final phase of meeting your water conditioning problem.

Call Graver today. Let us start now to carry your job a step further.

GRAVER

GRAVER WATER CONDITIONING CO.

216 West 14th St., New York 11, N. Y.

CHICAGO • PHILADELPHIA • CLEVELAND

A DIVISION OF GRAVER TANK & MFG. CO., INC. EAST CHICAGO, IND.

Only A. O. Smith gives you ONE source of

UNDIVIDED RESPONSIBILITY

with SMITHway Vertical Turbine Pumps

All major pump parts of A.O.Smith Pumps are designed together, built together, to *work* together—your assurance of years of dependable, low-cost service.

When you choose an A. O. Smith Pump, you know it is *all* A. O. Smith from motor to strainer—SMITHway all the way down. You can be sure that the sum of A. O. Smith's 75 years of experience has been engineered into *every* pump part, to give you a superiority you can depend on under the toughest operating conditions.

Weight Where Weight Belongs. A. O. Smith discharge-head assemblies are built of heavy steel plate, formed and welded into the strongest, most compact design. Support for the driver and suspended assemblies is rigid, vibrationless, yet easily accessible.

Bowls are precision-machined from hard, close-grained cast iron, fitted with smooth, streamlined diffusion vanes contoured for maximum efficiency. Bronze impellers, closed or semi-open, are dynamically and hydraulically balanced.

"Tailor-Made" for Each Job. Complete interchangeability of major assemblies lets you select the right combination of driver, column pipe, lubrication, and impeller to fit each pumping application. You have an application-engineered pump exactly right for each job.

Send the coupon for complete information!

CERTAIN PUMP TERRITORIES OPEN

Write or wire for details of the A. O. Smith Vertical Turbine Pump Distributor's Franchise, still available in a few territories. Send the coupon for our colorful illustrated Pump Bulletin.

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THE WORLD'S LARGEST TURBINE PLANT

Interior of General Electric Turbine Building, Heavy Equipment Area.

To meet the growing power demands of industry, General Electric Company retained Stone & Webster Engineering Corporation to design and construct at Schenectady, New York, its new turbine manufacturing plant.

The building, which is 650 feet wide by 1290 feet long, has a total floor area of more than 1,000,000 square feet. It required foundation construction of unusual design to carry the heavy loads to be superimposed on the manufacturing floor, which comprises nearly 20 acres.

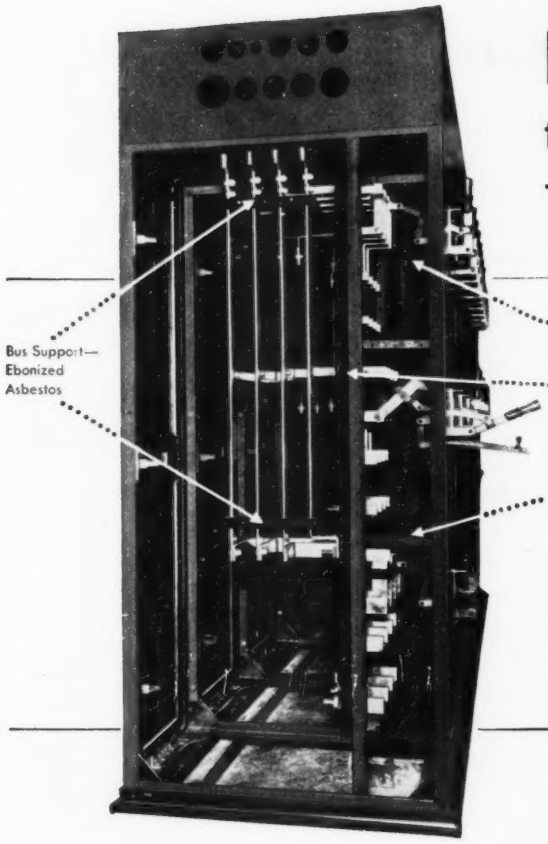
This plant when in full production will be capable of producing each month enough turbine-generators to supply power and light for a city of a million inhabitants.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

K&M EBONIZED ASBESTOS

for electrical mountings THAT GIVE YOU 3 HIGHS!



In addition to bus supports and mounting panels of K&M Ebonized Asbestos, this Pringle Switchboard has separators of K&M Monobestos—another versatile K&M material that betters electrical equipment.

High dielectric strength, high physical strength and high adaptability, all count in placing Ebonized Asbestos in much of the precise electrical equipment. Precision manufacture under high pressure, using specially developed raw materials, provides a product that can be readily machined, cut and drilled.

Pringle Electrical Manufacturing Company, Philadelphia, applies K&M Ebonized Asbestos to bus supports and mounting panels of the Dead Front Safety Knife Switch illustrated. The electrical safety factor is inherently high per unit of material. So is the mechanical safety factor, because there is strength in all directions with K&M Ebonized Asbestos. It particularly resists shock, vibration and temperature fluctuation.

These characteristics are valued by designers and engineers, for switchboard mountings, bus bar runs, compartment linings, test tables, bench boards and related applications. With K&M Ebonized Asbestos available in thicknesses from 1/8" to 4", any requirements can easily be met. For additional details write us; we'll answer you promptly.

K&M best in asbestos ®

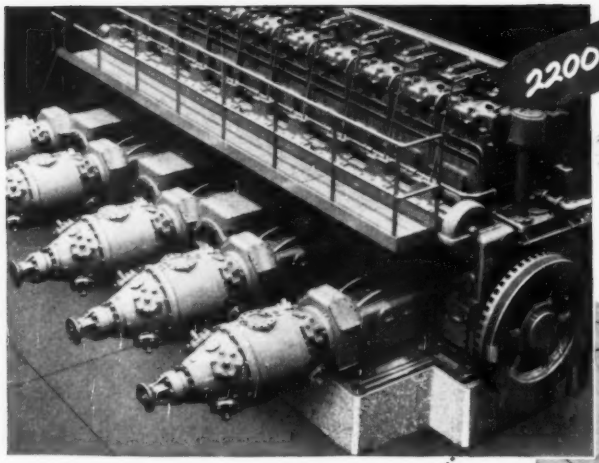
Nature made Asbestos . . .

Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

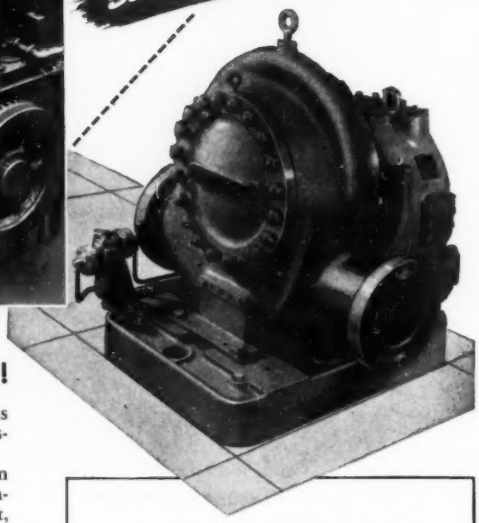
When your pipeline operations call for

BIG COMPRESSORS ...CALL IN CLARK!



2200 BHP GAS ENGINE DRIVEN

5500 BHP CENTRIFUGAL



The ONLY company that builds BOTH!

For large volume and high compression applications . . . call in the *one* company that builds *both* large Gas-Engine-Driven Compressors and Centrifugals.

Since we build both, we "have no axe to grind" in recommending the type best suited for your application. Each has its particular advantages . . . in first cost, operating cost, performance characteristics and installation requirements.

A Clark Bros. engineer will give you an unbiased analysis and recommendation on your large compressor needs . . . or any size compressor from 5 BHP up. Write or phone your nearest Clark Bros. office.

CLARK BROS. CO., INC. • OLEAN, NEW YORK

New York • Tulsa • Houston • Chicago • Boston • Washington
Los Angeles • London • Buenos Aires • Caracas, Venezuela

(Above Left) Clark BA-10 Big Angle, Gas-Engine-Driven Compressor for high compression applications. 10 cylinders, 2200 BHP.

(Above Right) Clark Single-Stage, Pedestal-Type, Centrifugal Pipeline Compressor of which there are several installed on the Big and Little Inch Pipelines.

CLARK

ONE OF THE DRESSER INDUSTRIES

SETS THE PACE IN COMPRESSOR PROGRESS

PFI STANDARDS for Uniform Fabricating Practices

benefit the user

of Pressure Piping

Machined Backing Rings and End Preparation for Butt Welds
Published by
THE PIPE FABRICATION INSTITUTE
Method of Dimensioning Welded Assemblies
Published by
THE PIPE FABRICATION INSTITUTE

The Pipe Fabrication Institute announces the availability of fabricating standards applicable to all types of pressure piping. These Standards, based on investigations and experience, have been compiled by the Engineering and Standards Committee of the PFI to satisfy numerous requests from designers, fabricators and users for standardized design features and procedures.

The use of these Standards by the designing engineer will help assure correct piping and maximum value per dollar of cost; it will also save time on the drawing board, in procurement of materials, and during the erection of the job.

If you desire copies of the two PFI Standards illustrated (and others as they are issued) simply fill in the coupon below and mail to the offices of the Institute. There is no charge or obligation.

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

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1108 Clark Bldg., Pittsburgh 22, Pa.

Please send me without cost the PFI Standards now available, also place my name on your mailing list to receive additional Standards as they are adopted.

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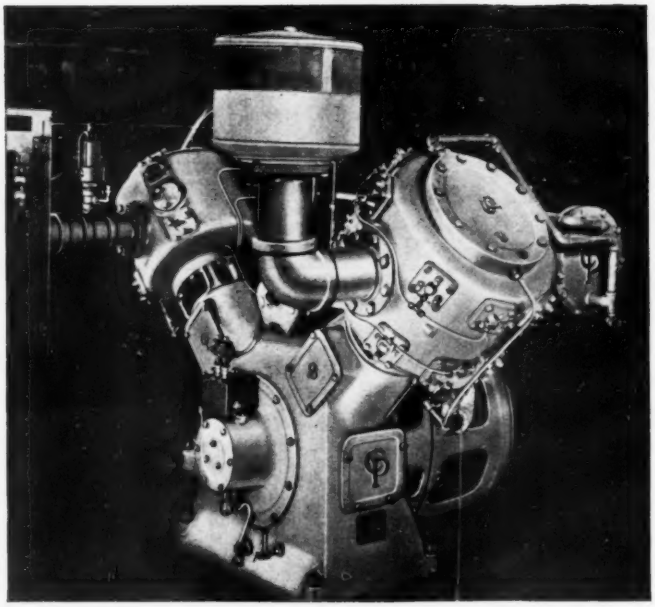
Title _____

Company _____

Address _____



here's the answer to restricted floor space

—the Type Y Compressor

While its compact design makes it ideal for close quarter installation—it has plenty of other outstanding advantages.

It is shipped intact as a "package unit," ready for external connections.

It requires only a simple foundation and no special skill is needed to align and install it.

It operates at high efficiency because of such valuable features as large area Simplate valves, multi-step capacity regulation, effective inter-cooling, precision bearings and force-feed lubrication.

And finally it's extremely easy on maintenance.

Available with built-in or direct-coupled motor, or with V-belt drive, in capacities of 500 to 900 c.f.m., at 80 to 125 pounds pressure. Sizes for other pressures also furnished.

Write for full information.

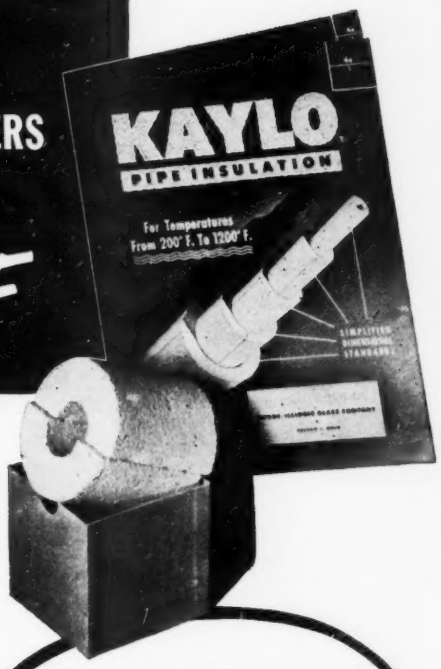
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

NOW!

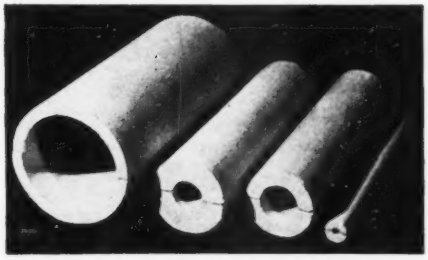
One PIPE INSULATION COVERS TEMPERATURES FROM 200°F. to 1200°F.



KAYLO®
PIPE INSULATION

Here's a real advance in pipe insulation you should know about—the broad adaptability of Kaylo Pipe Insulation in serving a 1000° range of temperature requirements. To get a Kaylo Pipe Insulation sample and descriptive folder, fill in and send the coupon below. These are some of the reasons you'll be interested:

- Kaylo Pipe Insulation offers remarkable efficiency from 200° up through 1200°. It withstands effects of vapor and water.
- Simplified Dimensional Standards of thicknesses and diameters allow snug-fitting nesting of successive layers, when necessary—simplify installation and permit minimum inventories.
- Easy to handle and apply, this strong, lightweight insulation can be cut, scored and sawed with standard tools.
- The experiences of varied industries with millions of feet of Kaylo Pipe Insulation attest to its wide-range efficiency and long service capacity.



Kaylo Pipe Insulation is available in nominal thicknesses from 1 to 3 inches in 36-in. sections, for pipe sizes from ½ inch to 12 inches. Kaylo Insulation is also available in block and lagging form.

MAIL COUPON FOR KAYLO PIPE INSULATION SAMPLE AND DESCRIPTIVE FOLDER

This new folder tells you all about Kaylo Pipe Insulation—the available sizes and recommended thicknesses for various temperatures; physical characteristics; efficiencies, and heat losses.

OWENS-ILLINOIS GLASS COMPANY
Kaylo Division **Toledo 1, Ohio**

SALES OFFICES AT:

Atlanta	Cincinnati	Philadelphia
Boston	Dallas	St. Louis
Buffalo	Minneapolis	Toledo
Chicago	New York	Washington

Owens-Illinois Glass Company — Kaylo Division
Dept. F-434, Toledo 1, Ohio

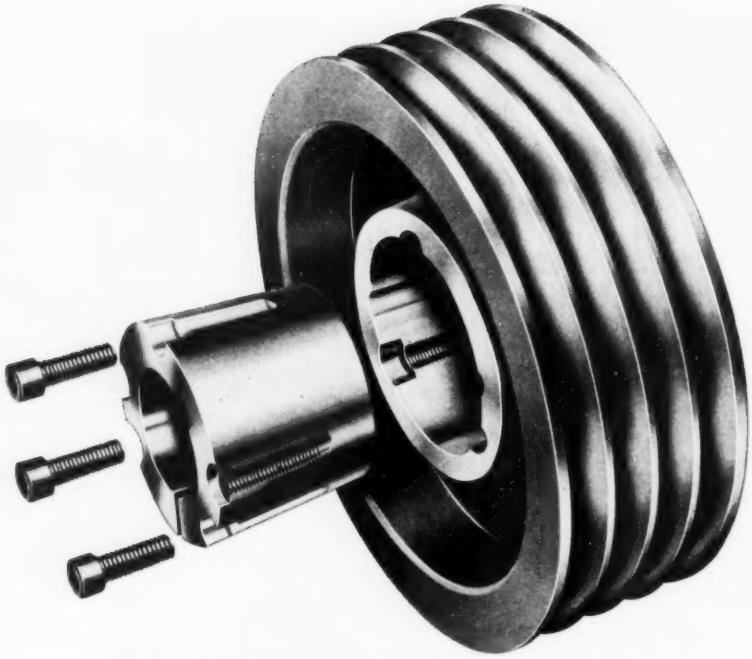
Gentlemen: Please send me a Kaylo Pipe Insulation sample and descriptive folder.

NAME.....

FIRM.....

ADDRESS.....

CITY.....STATE.....



The new idea in V-Belt Sheaves
that saves you time and money!
Proved in over 3/4 million installations!

TAPER-LOCK

1. No flange. No collar. It's different.
2. Easy on — easy off.
3. Just tighten the screws that wedge the bushing. Simple, isn't it?
4. Always a perfect fit on shaft — tight as "shrunk-on."
5. Complete range of sizes. A, B, C and D grooves, in stock.
6. Try it—and you'll standardize on it!

DODGE MANUFACTURING CORPORATION • MISHAWAKA, INDIANA

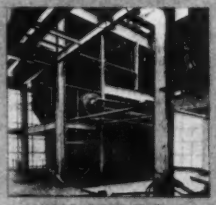
CALL THE TRANSMISSIONEER, your local Dodge Distributor, for information on new and better methods of transmitting power. Look for his name under "Power Transmission Equipment" in your classified telephone book.

DODGE
of Mishawaka, Ind.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

Also:

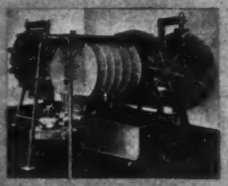


BOILERS

DEAERATORS
Any Capacity

CLOSED HEATERS

EVAPORATORS



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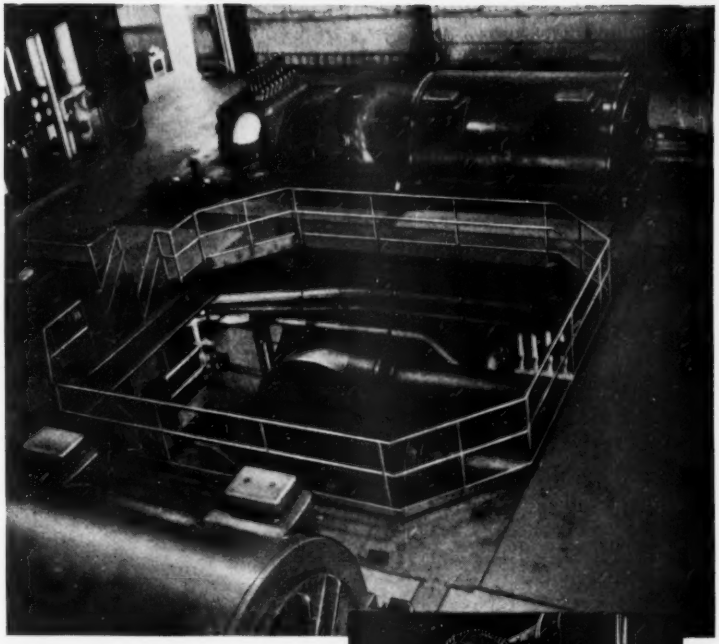


2 CONSECO CONDENSERS in Service Eighteen Months and a Third Unit . . . now on order

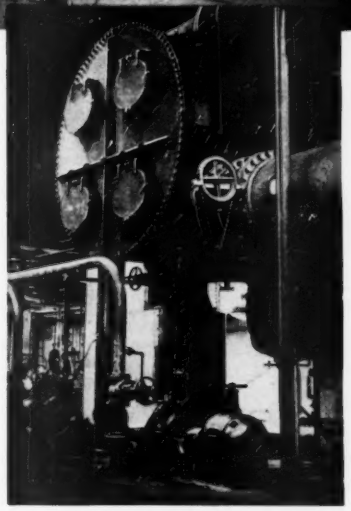
Plant: Dairyland Cooperative, Alma, Wisconsin (REA)

Consulting Engineers: Verne E. Alden Co., Chicago, Ill.

Generators: 2—15000 KW Turbines at .8 PF operating at 22,500 KVA constantly.

Condensers: 2—12000 sq. ft.; 2622 tubes, ⅞" O.D., 18 gauge; effective tube length 20'; tubes of Arsenical Admiralty; vacuum 1# approx.

REMARKS: Condenser guarantee exceeded. A third Conseco condenser unit now on order.

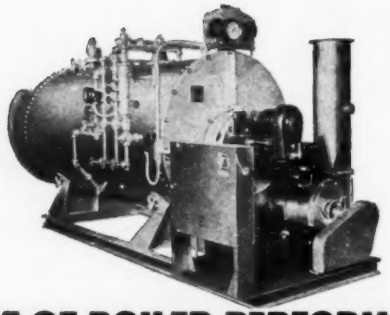


Avail yourselves of CONSECO's long, successful, specialized experience in the design and building of steam condensers, H. P. feed water heaters, deaerating feed water heaters, evaporators and any other type of heat exchanger.

CONSECO

Condenser Service & Engineering Co.

HOBOKEN, N. J.



PROOF OF BOILER PERFORMANCE:

REPEAT ORDERS

from....

- ALLIED CHEMICAL AND DYE CORP.
- ALUMINUM COMPANY OF AMERICA
- ASSOC. LAUNDRIES OF AMERICA, INC.
- AUSTIN COMPANY
- JOSEPH BANCROFT AND SONS CO.
- CANADA DRY GINGER ALE, INC.
- CHESAPEAKE AND POTOMAC TELEPHONE CO.
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- CRANE COMPANY
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- RUTGERS UNIVERSITY
- SPERRY PRODUCTS, INC.
- STATE OF NEW JERSEY
- UNITED CARR FASTNER CORP.
- ...AMERICA, INC.

These leading American enterprises—with complete confidence—re-ordered Preferred Unit Steam Generators. Why? . . . because they knew *from their own experience* that Preferred features assure them economical, trouble-free, long-life performance.

HERE ARE 7 MORE REASONS FOR REPEAT ORDERS:

★ INDUCED (PULL-THROUGH) DRAFT*
Eliminates need for costly stack . . . prevents escape of combustion gases into boiler room.

★ FULLY AUTOMATIC OPERATION
Even with No. 6 Oil.

★ PREFERRED ROTARY OIL BURNER
Built by Preferred especially for this unit.

★ FOUR-PASS GAS TRAVEL
Results in maximum heat absorption.

★ 80% MINIMUM THERMAL EFFICIENCY
Proved and guaranteed.

★ LOW MAINTENANCE
The result of over 27 years of combustion engineering experience.

★ FULL RANGE OF SIZES
From 20 to 500 H.P. and pressures up to 250 lbs.

* An example of the engineering "extras" behind Preferred's performance record is Induced (Pull-through) Draft. This distinctive feature permits air to be drawn around the outside of the refractory lining, thereby cooling the refractories and pre-heating the air. Combustion is aided . . . the life of the refractories is lengthened.

For complete details, write today for Bulletin 1000-F.

Two-pass 15 lb. pressure units available in 20-30 H.P. Minimum 75% thermal efficiency.

P-9-49

PREFERRED UTILITIES MANUFACTURING CORP. 1860 BROADWAY, NEW YORK 23, N. Y.

PR-172

PREFERRED UTILITIES MFG. CORP.

- ONLY ONE COAT NEEDED!
- EXTREMELY HIGH ADHESION!
- ADHERES TO BLOCKS, BLANKETS AND CEMENTS!

B-H POWERHOUSE CEMENT... the new finishing cement that insulates

EASY TO APPLY—EVEN OVERHEAD

- HIGH INSULATING EFFICIENCY!
- EASY WORKABILITY REDUCES LABOR!
- LINEAL SHRINKAGE UNDER 1%!
- SMOOTH, HARD SURFACE!
- EFFECTIVE UP TO 1700°

B-H POWERHOUSE CEMENT saves time, cuts costs—a one-coat application trowelled to required thickness in a single operation. Moreover, this new mineral-wool-base finishing cement takes a hydraulic set within two hours.

Its smooth hard finish is paintable. An attractive inside finish can be obtained with *any* paint. Outside, B-H Weatherseal gives permanent protection.

Easy on labor, easy on budget, B-H Powerhouse is the ideal *finishing-insulating* cement for industrial equipment. For full information and free sample, fill out the coupon.

Baldwin-Hill Company, 737 Breunig Ave., · Trenton, N. J.

Baldwin-Hill Company
737 Breunig Avenue
Trenton 2, N. J.

Please send me complete information on B-H Powerhouse Cement.

NAME.....POSITION.....

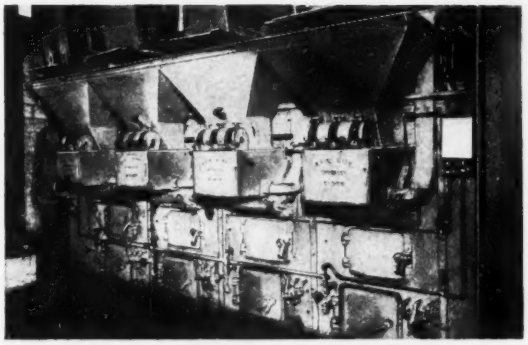
FIRM.....

ADDRESS.....

TAMES A
POWER THROB
FLEXINEERING ELIMINATES VIBRATION ON TUG DIESEL EXHAUST
. . . PROVIDES SMOOTHER POWER . . . COOLER OPERATION
When the giant 16 cylinder, 1750 horsepower diesel engine of the new tugboat, Grace Moran, roars into action, there's a smooth purr of silky power. And one of the keys to this vibration-free operation is "flexineering"—the scientific engineering of flexible metallic tubing to industry's specific needs.
From the exhaust to the stack is a five foot length of Penflex air jacketed 14 inch, interlocked, flexible metallic tubing which achieves a circulation of air and an efficient cooling action.
Tough, rugged tubing that keeps exhausts as tight as a pipe . . . yet provides all of the flexibility necessary to "soak up" the constant vibration.
In the power field—whether it is on exhaust lines, air lines or the many other places where tubing is used—you will find Penflex engineers ready to help you solve your problems. Penflex tubing is available in bronze, galvanized steel and stainless steel . . . in sizes from 1/8 inch I. D. to 24 inch I. D. Write for your copy of "Flexineering."
PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7238 Powers Lane
Philadelphia 42, Penna.
Branch Sales Offices
BOSTON • NEW YORK • CLEVELAND
CHICAGO • HOUSTON • LOS ANGELES
Penflex . . . HEART OF INDUSTRY'S LIFE LINES

Copyright 1949—Penna. Flexible Metallic Tubing Co.

For a SPREADER STOKER *Consult* ERIE CITY



Erie City Spreader Stoker firing Erie City 50,000 pounds per hour boiler in a mid-western chemical plant.

—a manufacturer, for over 100 years, of steam generating equipment. This long experience with boilers of all types and capacities particularly qualifies Erie City to build stokers. This Erie City Spreader Stoker burns a wide range of coals efficiently and economically. For complete details

Write for Bulletin **SB-31** ➡

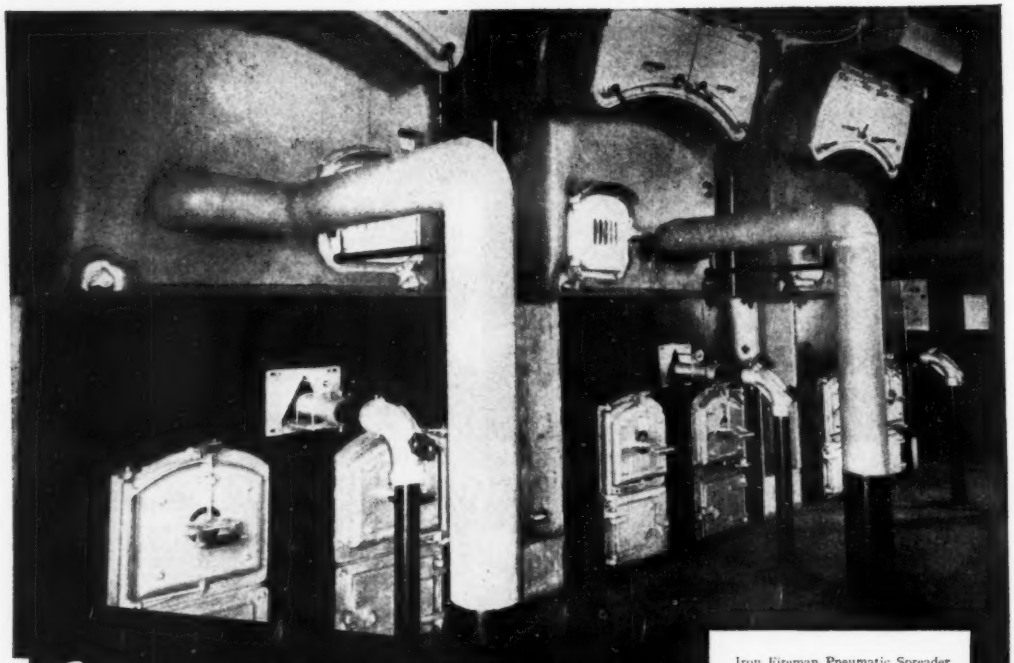
ERIE CITY

COMPLETE STEAM POWER PLANT EQUIPMENT

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

Can you afford to waste what Iron Fireman users are saving?



New IRON FIREMAN
PNEUMATIC SPREADER STOKER
has these fuel saving features

Iron Fireman Pneumatic Spreader Stokers firing from basement bunkers. Coal is automatically elevated on a stream of preheated air. Iron Fireman's flexible conveying system is adaptable to almost any boiler room layout. Saves the cost of labor for coal handling and expensive conveying equipment.

Steam size coal is metered from hopper or bunker, dried, heated and transported to furnace by pneumatic conveyor. Distributing nozzles accurately spread larger particles of coal over entire grate in a shallow, uniform fuel bed. Preheated fines burn in suspension, reducing cinder carryover and improving combustion efficiency and responsiveness, as compared with other stokers which do not preheat fuel.

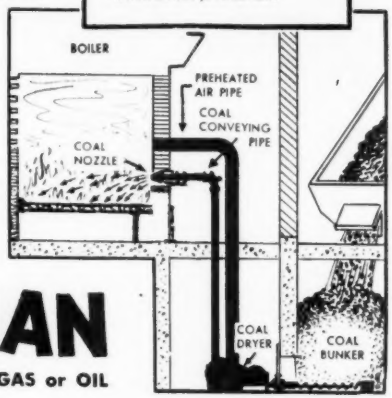
Dries Wet Coal. Coal is thoroughly dried and preheated as it is conveyed to furnace. This assures uniform coal distribution on the grates and maximum combustion efficiency.

Preheats Coal. Preheated fines burn in suspension, reducing cinder carryover and improving combustion efficiency and responsiveness as compared with stokers which do not preheat coal.

Automatically Syncronizes Coal and Air Supply. Increases combustion efficiency by keeping air supply in step with coal feed-rate at all times. New Infinitely Variable Transmission enables quick and exact adjustment of stoker output to meet load demands, particularly with full floating air controls.

Handles coal sizes from fines to 2". Burns all grades of coal efficiently, including sub-bituminous and lignite. Capacities up to 4000 pounds of coal per nozzle per hour.

Write for free information on how to cut fuel and labor costs with Iron Fireman firing. Iron Fireman Mfg. Co., 3125 West 106th St., Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Ontario.



IRON FIREMAN
Commercial and Industrial Firing with COAL, GAS or OIL

R/M "PYROID"
COMPRESSED ASBESTOS SHEET PACKING

R/M No. 650

For public utilities; for power plants; for hydraulic and pneumatic systems; for pumps, valves, compressors, and all kinds of industrial machinery, Raybestos-Manhattan manufactures a diversified line of packings that can be relied on for long, trouble-free service.

R/M "Pyroid" Compressed Asbestos Sheet Packing, No. 650, is the standard in thousands of power plants and refineries, where it is called upon to resist high pressures and temperatures and the solvent action of petroleum derivatives. A dense pliable sheet of exceptional tensile strength, "Pyroid" is made by America's biggest manufacturer of sheet packing.

R/M No. 670 is a compressed asbestos sheet widely used where low first cost is important. It combines pliability with tensile strength. It has a very low rubber content and has been approved by the National Board of Fire Underwriters for use with gasoline, benzol, kerosene, and other hazardous liquids.

For information on other R/M asbestos and rubber sheet packings, or for information on the full line of R/M packings and gaskets for industry, call the authorized R/M packing distributor near you. Ask for the R/M Packing Catalog.

R/M

RAYBESTOS - MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

Factories: Bridgeport, Conn.; Manheim, Pa. No. Charleston, S.C.; Passaic, N.J.

RAYBESTOS MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings Fan Belts • Radiator Hose • Powdered Metal Products • Bowling Balls

All These Were Once

DUST COLLECTION PROBLEMS, TOO

48 Carbon Black Plants

203 Metallurgical Installations

205 Acid Plants

40 Paper Mills

270 Detarring Installations

216 Power Stations

73 Steel Plants

99 Oil Refineries and Miscellaneous Installations

Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blue prints.

This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems.*

In hundreds of power plants today, Research Corporation Cottrells are collecting 90% to over 99% of fly ash from pulverized fuel boilers. Write for your free copy of an informative booklet giving valuable data on these installations. RC-116

Typical One Day Collections:

250 TONS OF FLY ASH • 6 TONS OF SODA SALTS AT A PAPER MILL • 25 TONS OF SODIUM SULPHATE AT A KRAFT MILL • 6 TONS OF BLAST FURNACE DUST

RESEARCH CORPORATION

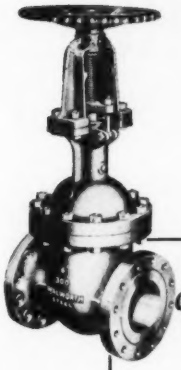
405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

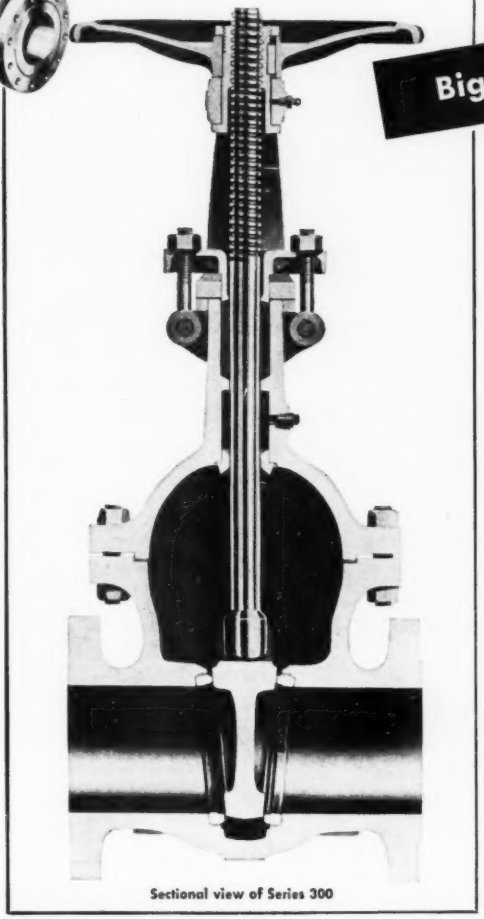
WALWORTH

Cast Steel Gate Valves

Series 150 and 300

Wedge Gate — Outside Screw and Yoke





Sectional view of Series 300

Big 8-Point Superiority!

Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2" to 24") insure tightness and maximum packing life – costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion – they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated – not flange type. No recess exists at back of ring – hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

For further information on Walworth Cast Steel Gate Valves, see your local Walworth distributor, or write:

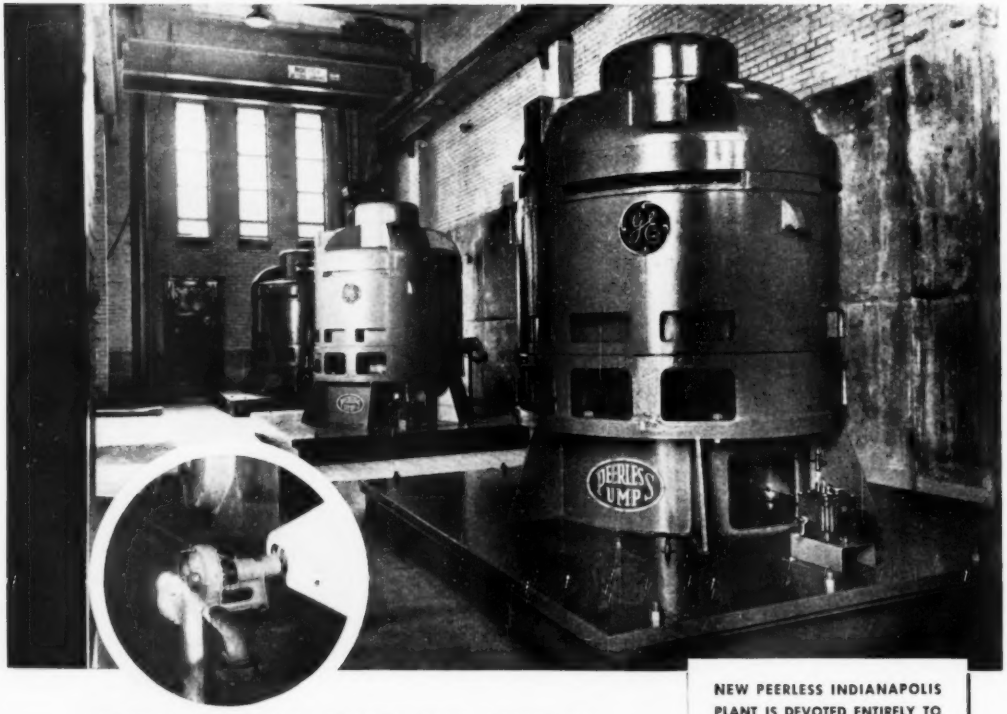
WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

WIDEST CAPACITY RANGE



FROM A COMPREHENSIVE LINE OF VERTICAL AND HORIZONTAL PUMPS

Peerless offers 2 to 220,000 gallons per minute

A tapful or a torrent? No matter what your water capacity requirements are, Peerless can meet your pumping needs.

Fractional hp horizontals, like the Peerless "Fluidyne" pumps handling cooling-jacket water in the inset above, furnish a few gallons a minute. The huge Peerless mixed-flow pumps in the larger photo, pump away drainage water at the rate of tens of thousands of gallons a minute.

Widest capacity range is but one of a host of reasons why industries, municipalities and commercial businesses plan with Peerless for all their needs for pumps. Here are others:

ALL PRACTICAL HEADS: Lifting water from 1000 feet or more is a practical accomplishment of Peerless vertical deep well pumps. Pumping against heads of 690 feet is a common task for Peerless horizontal centrifugal pumps.

ALL TYPES OF DRIVE: Electric motor, right angle gear, engine, belt (V or flat) or combinations of the above, are all available from Peerless, with pump and driver engineered as a unit.

MODERN DESIGN: Peerless pumps are designed for top flight performance over extended periods of time. And the practical consideration of ease of maintenance and repair is figured in to their functional, good looking design.

NATIONWIDE SERVICE: Peerless sales and field service is available in all principal U. S. cities and abroad. Plan with Peerless for all your pumping needs. Individual bulletins on all types of Peerless Pumps are available upon request.

NEW PEERLESS INDIANAPOLIS PLANT IS DEVOTED ENTIRELY TO PUMP PRODUCTION AND SERVICE

Here is one of America's newest pump plants—19 acres of modern manufacturing facilities devoted to precision production of horizontal and vertical pumps, centrally located at Indianapolis. Plan with Peerless for pumps plus fast, complete pump service.

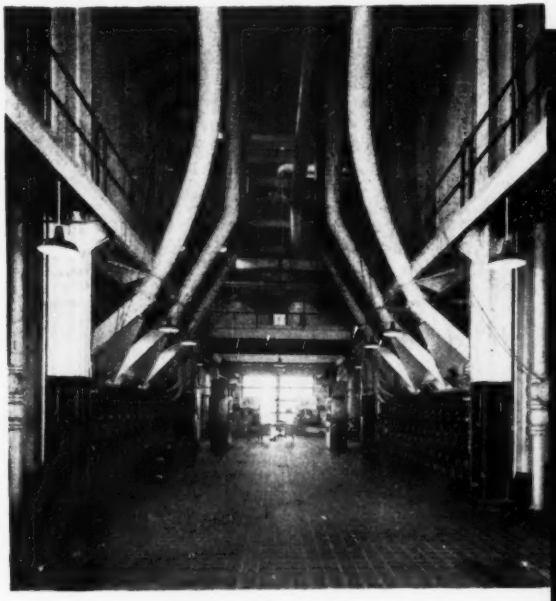
Peerless
VERTICAL AND HORIZONTAL
Pumps

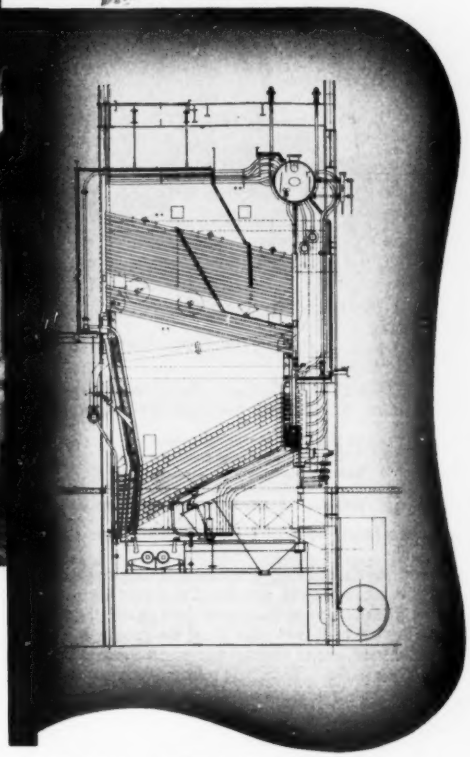
fmc
PEERLESS PUMPS

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Los Angeles 31, California — Indianapolis, Indiana
District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 N. Broadway; Atlanta Office: Rutland Bldg., Decatur, Ga.; Omaha, Nebr., 4330 Leavenworth Street; Dallas 1, Texas, 3905 Elm Street; Fresno, Calif.; Los Angeles 31, Calif.

Federal Works Agency Photos

More Heat for the NATION'S CAPITAL





New $8,000,000
WEST HEATING PLANT
Washington, D. C.

Served By

Vogt FORGED STEEL SECTIONAL HEADER

STEAM GENERATORS

ADDITIONAL ORDER NOW BEING FABRICATED FOR THIS PLANT

•

Principal Data, Each Unit

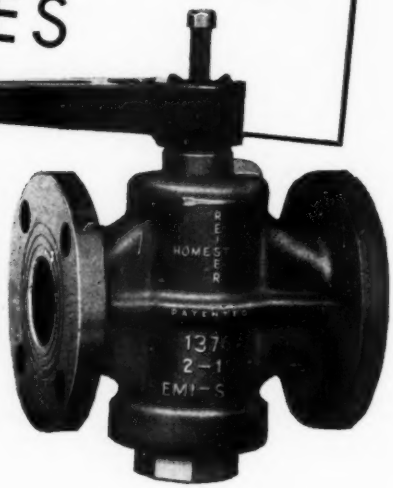
220,000 pounds steam per hour capacity Steam and water drum is fusion welded and designed for 400 pounds S.W.P. Sinuous forged steel tube headers. Water cooled furnace walls.

HENRY VOGT MACHINE CO.
Louisville 10, Kentucky

BRANCH OFFICES:
New York • Philadelphia • Cleveland
Chicago • St. Louis • Dallas

You can't buy A LOWER COST-PER-YEAR VALVE than

HOMESTEAD-REISER *Self-Sealed* LUBRICATED PLUG VALVES



They are the lowest-priced, full-port-area plug valves in their pressure and temperature range

And they *outlast* all other lubricated plug valves in their class. Every one of their many outstanding advantages including

100% area of standard pipe
100% lubricant seal around ports
Extreme economy of lubricant
Single lubricant for wide variety of applications, and
Self-sealing automatic adjustment for wear

. . . are features asked for by engineers and operating men of industry.

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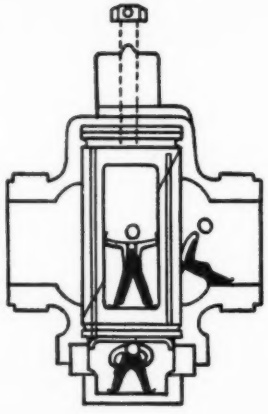
Why not send today for your free copy of Valve Reference Book No. 39-5? *It shows sizes, types and pressure ratings for Homestead-Reiser Valves.*

How the "*Self-Sealed*" Principle Works

In addition to a full lubricant seal around the ports and around the top and bottom of the valve, the wedge-action of the plug under line pressure, constantly presses the finely-finished surfaces of the plug outward against the seating surfaces of the body. This self-sealing action keeps the plug surfaces in contact at all times with the mirror-like bore of the body. The plug thus automatically adjusts itself for wear, assuring extra long life and maximum leakless service.



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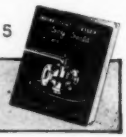

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LIGHTNING can and does strike at unpredictable times and places. When it does, protection to life and property and the correct functioning of electrical equipment depend largely on suitable and permanent ground connections—connections that are maintained in a condition to perform the service for which they were designed and installed.

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THE HEAVY DUTY "MEGGER" TYPE—built for ruggedness and durability—housed in a teakwood case. Has proportionately divided scales from 0 to 1 ohm (reading in .01 ohm) to as high as 0 to 30,000 ohms, with three, four or five ranges in the same instrument.

THE "MEG" TYPE—smaller and lighter, weighing only 8 pounds—mounted in a cast aluminum case. Scales are logarithmic in character, so as to cover as wide a range as possible within the limits of practical field accuracy. Ranges are single or double up to 3,000 ohms.

For a complete description of "Megger" Ground Testers and the "hows" and "whys" of ground resistance measurement, we invite you to write NOW for Catalog 25-P.

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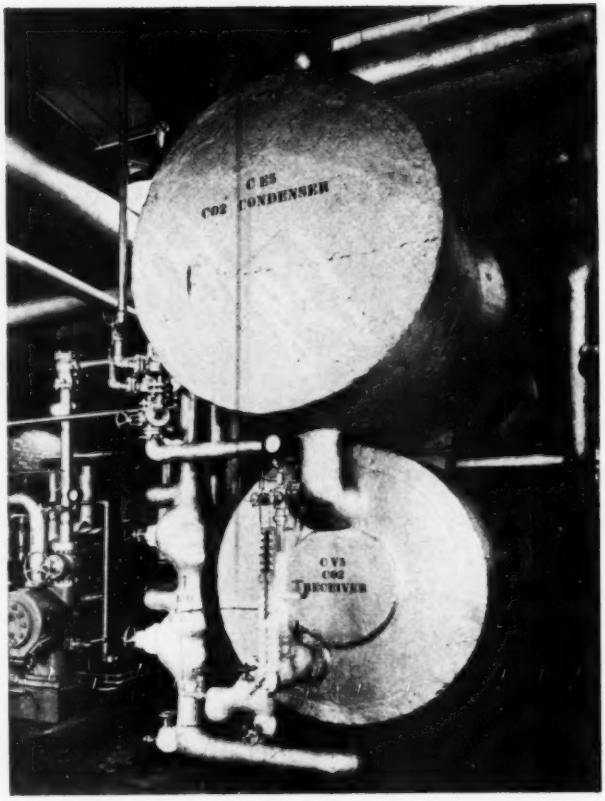
Lummus-built CO_2 *condenser helps* PURECO TURN ON THE COLD



At its new Chicago plant, Pure Carbonic, Incorporated, can produce 140 tons per day of solid carbon dioxide at high levels of efficiency.

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Shown above is a kettle-type all steel CO_2 condenser with 3200 sq. ft. of tubular surface. The same plant includes a Lummus-built heat exchanger for CO_2 and ammonia, having 355 sq. ft. of tubular surface, with seamless stainless steel tubes.

Heat transfer equipment by Lummus is the choice of performance-minded engineers throughout the power and process industries. Lummus has an unique background of experience on both conventional and highly specialized units involving top limits of pressure, temperature and corrosive conditions.

Write for new bulletin—Lummus Heat Transfer Equipment (Bulletin M 303) is a new 16-page publication giving details, design data, and application information. For your copy, address The Lummus Company, Heat Exchanger Division, 259 West 14th Street, New York 11, New York.

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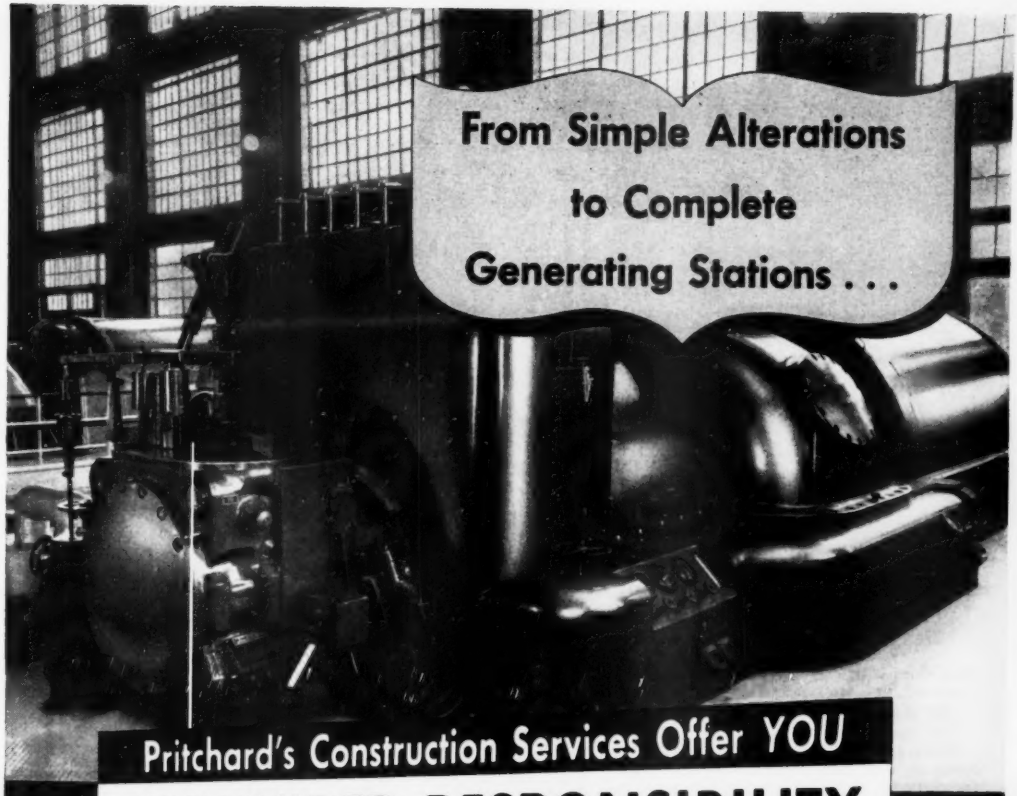

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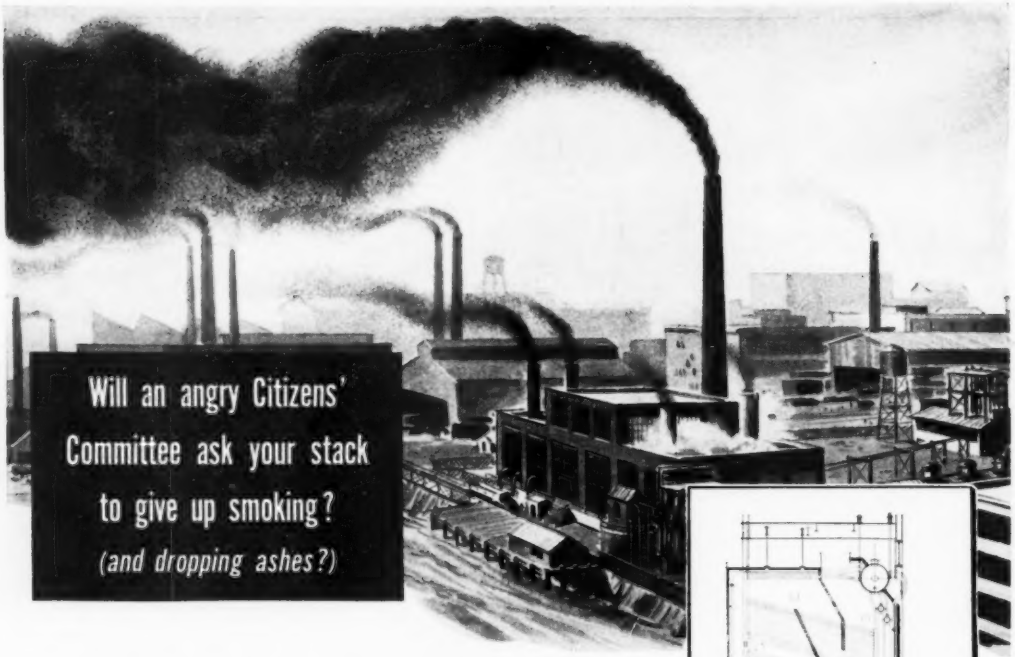


How does your stack stand in your community? Is it acceptable and accepted, or a frequent cause of community contempt?

Few plants today can risk the indignation of their neighbors.

You can do something about it.

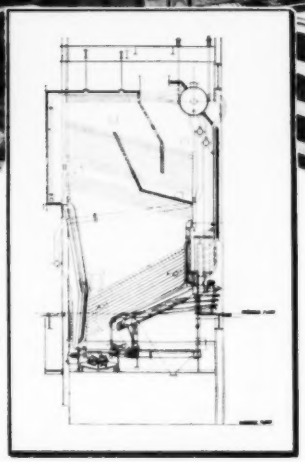
It is a fact—though sometimes overlooked—that properly designed furnaces and multiple retort underfeed stokers are operating satisfactorily to all in the heart of cities *without fly ash collectors.*

It is also a fact that multiple retort underfeed stokers at low ratings create no smoke problem at all. Think of it—no worries about smoke even at low ratings. Remember, too, that the elimination of fly ash collectors means lower draft losses and frequently eliminates the need for induced draft fans.

Taylor Multiple Retort Underfeed Stokers of adequate grate area deliver over 90% of the ash to the ashpit. Most of the particles which do leave the furnace can easily be collected without *expensive* dust recovery equipment.

So why use your community for an ash tray? It is so easy to prevent or end your smoke and fly ash difficulties with Taylor Stokers. They burn coal from Nebraska to the Atlantic, as well as in Canada, Britain and the Continent.

Whether you're converting your present combustion system, or building from scratch, Taylor Stokers adapt to present or future conditions, type of equipment, growth and change of power service requirements. For efficient, low-cost steam production and freedom from objectionable stack discharge, get full details of Taylor Stokers today. Our 20-page, fully illustrated Catalog is yours for the asking. Send for it now.



Washington, D. C., is extra fussy about the stack nuisance. Modern heating plant in Washington, D. C., originally installed 2 water-cooled Taylor Multiple Retort Underfeed Stokers—recently ordered a third. Each of 2 units handles 150,000 lbs. per hour normal steam flow, and 240,000 lbs. per hour peak loads. Taylor Stokers meet the smoke requirements of any city.

FREE *This "fact-packed" booklet on the improved Taylor Stoker. Write for your copy today. No obligation.*

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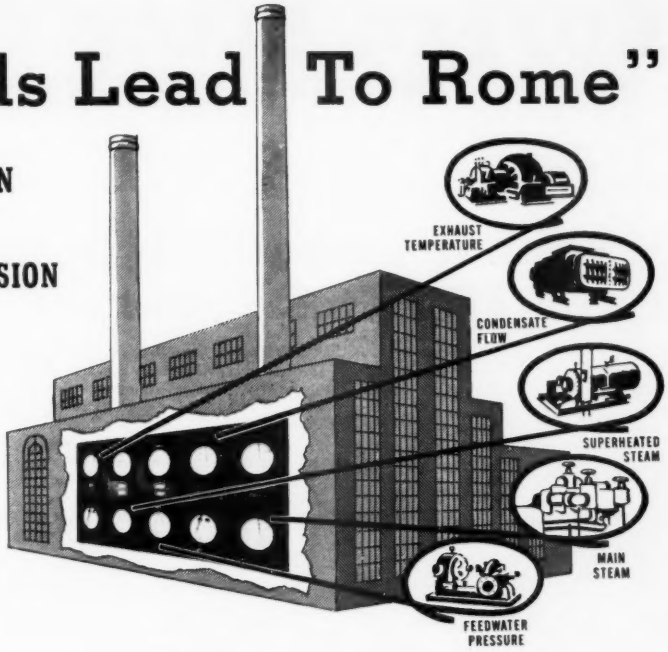

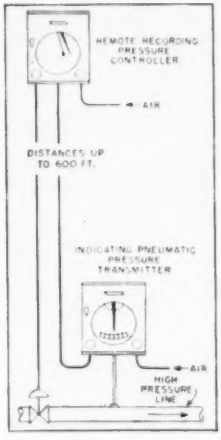

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The Brown Pneumatic Transmission System is simple and accurate. It eliminates long runs of expensive high pressure piping . . . and brings the cost of centralized instrumentation within reach. The system provides ample power, without appreciable lag, over long distances.

Used by the tens of thousands in the petroleum industry, Brown Pneumatic Remote Transmission is now finding wide acceptance with power engineers.

Investigate Brown Pneumatic Transmission for increased efficiency in your plant. Call in your local Honeywell engineer . . . he is as near as your phone!

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COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Which Tube Alloy Should Be Specified For Marine Condensers?

There is a great difference of opinion among operating engineers as to which condenser tube alloy is most satisfactory. Some continue to stick by Admiralty which they claim is giving excellent results. Others have switched from Admiralty to Aluminum Brass because of troubles from impingement corrosion. We all know that the U. S. Navy favors 70-30 Cupro Nickel and is well satisfied with this alloy.

It would seem, therefore, that the success of an alloy depends upon a number of things – the operating conditions and the condenser design being among the most important.

Impingement Corrosion

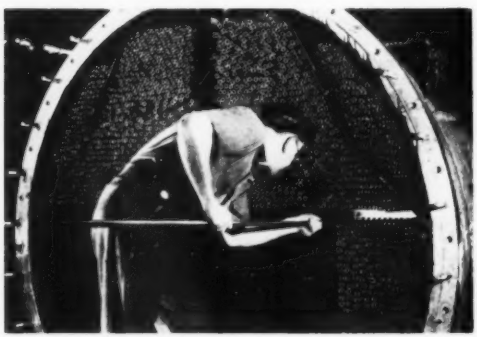
We know that corrosion-erosion attack of condenser tubes is greatly aggravated by turbulence at the inlet end. This is often combatted mechanically by covering the inlet area with Flowrites, short pieces of flared tubings turned down to a feather edge on the opposite end, that are inserted at the inlet end. This restricts the I.D. of the tube somewhat but has some advantages in blocking larger obstructions right at the entrance.

Another method of combatting the effects of corrosion-erosion is to use an alloy that is more resistant to this type of attack. For example, Aluminum Brass and Duronze IV (Arsenical Aluminum Bronze) and Cupro Nickel are more resistant than Admiralty.

And, still another method of reducing impingement corrosion is to tackle it at its source. Admitting that the problem concerns turbulence, operating conditions and condenser design play an important part. Keeping the water velocity down to 4 feet per second where possible and not exceeding 7.0 feet per second under full power conditions is very helpful. Providing adequate sized water boxes with good air venting facilities are steps in this direction.

Importance of Cleaning

Foreign particles lodging in the tube or settling on the bottom such as sand, coal, ash, shells, mud, scale, slime, etc. may lead to serious corrosive attack. The remedy is obvious – frequent inspection and cleaning. Water lancing will drive out obstructions. The use of rubber bladed revolving tube cleaners are preferred to prevent harm to the protective film which is deposited in the tubes soon after being in service. Cleaning and flushing of tubes is most important after the vessel has been in operation in a shallow harbor containing polluted water.



Condenser tubes must be carefully installed. Courtesy Allis-Chalmers Mfg. Co., Milwaukee, Wisc.

Steam Erosion and Vibration

Erosion of the outside surface of the tubing in the path of incoming high velocity moisture laden steam may cause trouble and can be corrected by proper baffling. Transverse cracking of tubes from excessive vibration can be reduced by improving tube support and by weaving flattened tubes between the others to dampen vibration.

Stress Corrosion

Occasionally condenser tubing and pipe fail from stress corrosion cracking or season cracking resulting from the combined action of corrosion and high static stresses. Stress corrosion or stress corrosion cracking are the terms commonly used to describe cracking failures from stresses set up when a tube is held in a bent or twisted position or carrying a load, or not permitted to freely expand or contract. Frequently it is difficult to detect the origin of the stresses after failure has taken place. Laboratory tests, however, have shown that these cracks develop at right angles to the direction of the applied stress.

Season cracking is the term which is used to describe the failure of brass from internal stresses which may result from the cold working of the metal such as cold drawing, bending, twisting or hammering.

Stress corrosion cracking in different metals is generally associated with specific environments. For example, the combined action of at least three substances: ammonia or ammonia-producing material (organic and inorganic substances containing nitrogen), water and oxygen are necessary to produce stress corrosion cracks in brass.

Often this combination of substances will be found on the surface of a tube or pipe through which cold water is flowing and the condensation of moisture from air or steam occurs on the tube surface. Oxygen and traces of ammonia from various sources may dissolve in this film of water. The corrosion products which form under these conditions frequently are dark colored such as dark blue, black or dark brown with only a small amount of metal being actually corroded. The failure may develop within a few hours or after several years and depends upon the magnitude of the stresses and corrosive medium.

Laboratory Service Available

Summarizing, there are many factors which influence condenser tube life. Those which cannot be corrected through the operating practice and because of condenser design can often be offset through a change in alloy and strict schedule of cleaning procedure. Bridgeport's laboratory will be glad to help on condenser tube problems. Our Condenser Tube Manual contains much information on corrosion, alloy characteristics and recommendations. Write for your copy of this 120 page booklet.

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* For maximum comfort and lowest operating cost, temperature of air leaving unit heater should be between 110 -120 F. at standard conditions.

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Built-in Velocity generator effectively increases heat throw without increasing power requirements. Outlet air retains a large share of its initial velocity to penetrate cold air strata near floor.

Get new Modine Unit Heater Bulletin today! Also available — "How To Evaluate Unit Heater Performance Characteristics." Your Modine Representative listed in Classified section of phone book. Or write Modine Mfg. Co., 1512 Dekoven Ave., Racine, Wis.

Here's what you get with Modines!

• LOWER OPERATING COSTS

Modine Unit Heaters deliver heat down into comfort zones where heat is needed instead of wasting it on ceilings or above the heads of room occupants. *This means lower fuel costs!* Only unit heaters with sufficient air velocity and correctly related outlet temperatures can give you this performance.

High quality split-phase or capacitor motors (instead of less expensive shaded-pole motors) are used on all but the smallest Modine Unit Heaters. *This means lower power and motor maintenance costs!*

• UNIFORM HEATING COMFORT

Overheated outlet air is buoyant and rises quickly. Underheated air feels "chilly." Similarly, excessive air velocity causes drafts, while air delivered with insufficient velocity fails to reach the floor.

Because Modine outlet temperatures and velocities are *right*, and correctly related to each other, hot blasts and cold drafts are avoided. Floors are kept comfortably warm. Heating is uniform in all parts of the room even in coldest weather.

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Entire condenser is pure copper and copper alloy . . . for maximum resistance to electrolysis and corrosion. Tubes are red brass; fins and headers, copper.

Differential expansion stresses are safely absorbed by bends in individual tubes and are not transmitted to tube-header joints to cause condenser fracture.

Fins are permanently bonded to tubes with metal. All condenser joints are brazed. There are no screwed or expanded joints to weaken condenser structure.

Parker-Bonderizing protects castings and sheet metal parts against formation and spread of rust. Anchors paint to steel. Prolongs original attractive finish.

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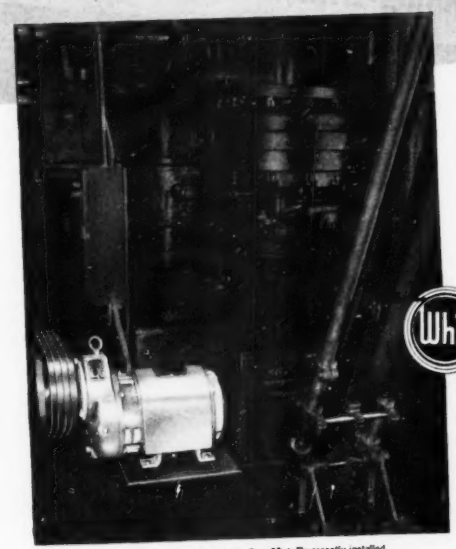

Above: Showing one of four 3 H.P. Philadelphia GearMotoRs recently installed by the R. M. Hollingshead Corp., Camden, N. J. Motor speed—1750 R.P.M.; output speed—350 R.P.M.; Reduction ratio is 5.1. Driving a square can seamer.

Above: Showing one of two 1 H.P. Philadelphia GearMotoRs installed in the Front Royal Plant of American Viscose Corp. Motor Speed—1750 R.P.M.; output speed—125 R.P.M.; Reduction ratio is 15.1.

Here are some of the reasons why the **Philadelphia GearMotoR** is being used by hundreds of companies throughout industry: It is a self-contained, extremely compact unit that conforms to recommended standards of A.G.M.A. and N.E.M.A.; it is available in single, double and triple reductions . . . and the range of speeds run from 780 through 7.5 R.P.M.; motor rating from 1 H.P. through 60 H.P. . . . A-c or D-c. Motors are precision-built and fit perfectly with gear unit. Gears are of the helical type, long-lived and quiet in operation; made of quality alloy steel, precision machined (teeth shaved) and induction-hardened. Assembly is very simple: Motor and gear units are each self-contained, yet readily separated; gears in multi-reduction units may be inspected without uncoupling from driven machine. Lubrication is of the positive "splash type," with large reservoir. Gear housing is leak-proof, and motor, which is greased independently, has double-shielded ball bearing design.

Send for 42-page illustrated catalog, containing full information and data necessary for ordering, and please use your Business Letterhead when requesting same.

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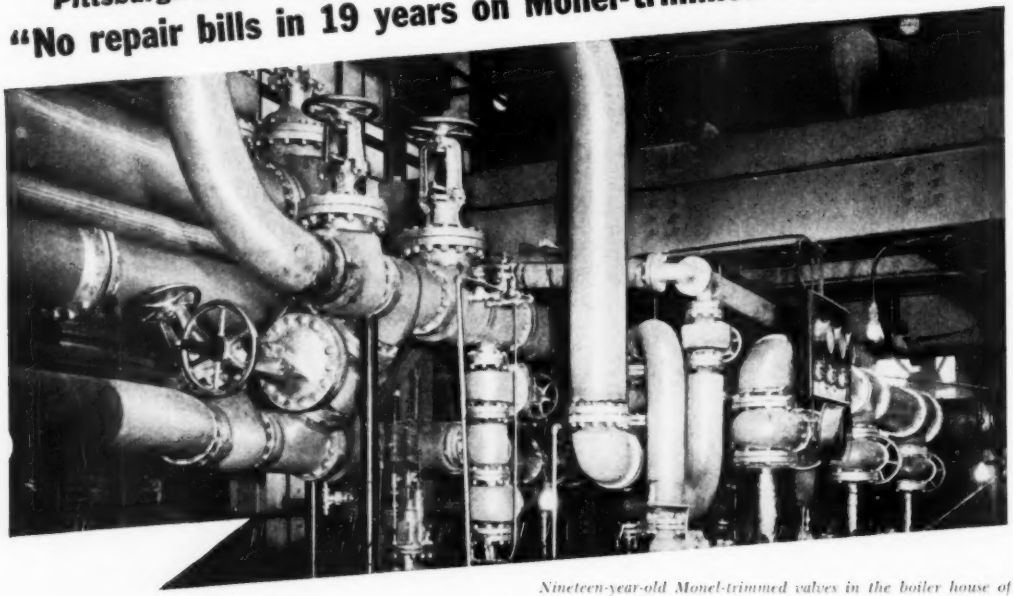
Pittsburgh Coke and Chemical Company reports:

"No repair bills in 19 years on Monel-trimmed steam valves"



Nineteen-year-old Monel-trimmed valves in the boiler house of Pittsburgh Coke and Chemical Company. Valves were manufactured by the Pittsburgh Foundry and Construction Company, Pittsburgh, Pa.

IN 1929, a set of Monel-trimmed cast steel globe, gate, and non-return valves were installed in the boiler house of the Pittsburgh Coke and Chemical Company, Pittsburgh, Pa.

These valves—manufactured by the Pittsburgh Foundry and Construction Company—were equipped with MONEL* stems, seats, discs, dash pots, and back seating collars.

Nineteen years later, Mr. Guy Lewis, Superintendent of Power and Steam for the Pittsburgh Coke and Chemical Company, has this to say:

> *"These valves have never been repaired nor replaced. Since 1929 they have been in constant service, and are still operating perfectly. As you know, we use a chemical in our feed water which is very hard on valve trim. Last year we inspected a check valve and found this valve to be like new."*

Reports such as this—on the fine performance of MONEL-trimmed valves—are the rule rather than the exception. For MONEL offers excellent protection against rust, corrosion, excessive wear, and heat-scaling. It is harder than most other nonferrous alloys, with good heat-resistance and strength exceeding that of structural steel.

Next time you need valves, specify MONEL trim and insure yourself for years to come against costly repair bills and replacements. Most leading valve manufacturers stock MONEL-trimmed valves for all power plant requirements.

For more information on Monel for valve trim, write R. F. Johnson of Inco.

*Reg. U. S. Pat. Off.

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Prat-Daniel Fan Stacks, however, offer an integrated induced draft system, combining the three elements of stack, breeching and I.D. fan, into one complete induced draft unit, each component designed to work with the other to produce the highest efficiency.

Prat-Daniel Fan Stacks are built to give your boiler a predetermined draft without excessive "safety factors" necessary with un-coordinated systems. They are completely fabricated and guaranteed by one responsible company . . . a company that has been designing and manufacturing draft-producing equipment for over a quarter of a century.

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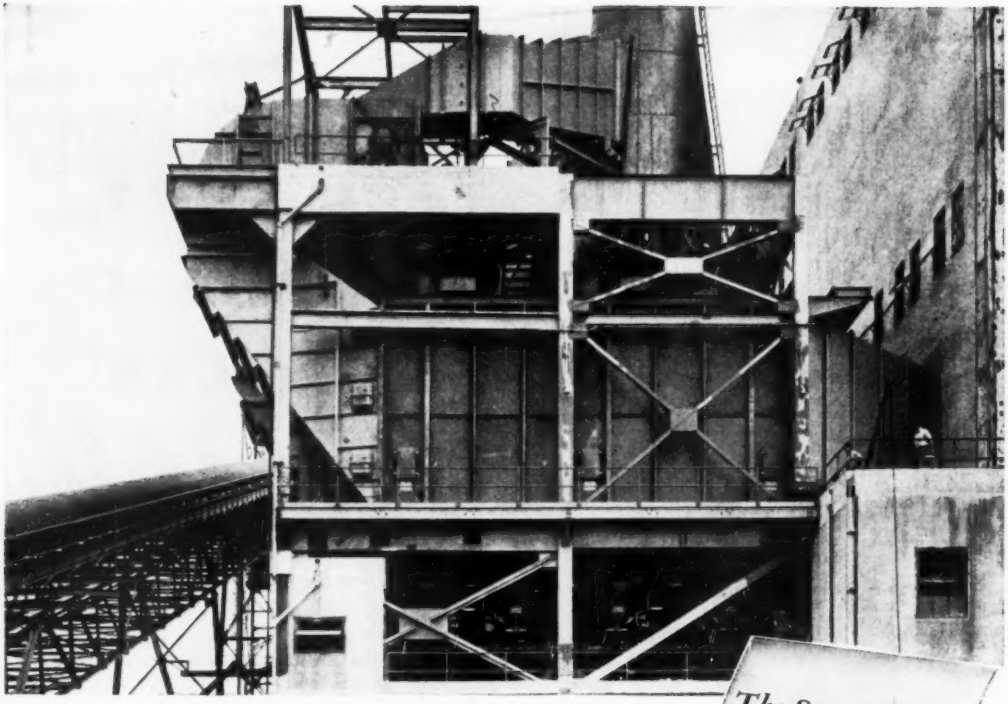

The Story Behind
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KOPPERS-ELEX electrostatic precipitators, like those in this installation, provide maximum *guaranteed* nuisance abatement . . . and improve public relations by helping make your community clean and healthy.

Although fly ash emitted to the atmosphere may vary from 0.75 to 0.25 grains per cubic foot under municipal ordinances . . . these results do not provide nuisance abatement that meets public demand. But Koppers-Elex can limit residuals to *.15 grains or less*, uniformly emitted . . . a *guaranteed* performance which protects your interests *now and in the future* by providing maximum nuisance abatement under all conditions!

Koppers-Elex precipitators assure you of *maximum efficiency* and *performance as guaranteed* . . . results of the experience gained in over 1000 successful applications. So, for superior recovery or removal of material from industrial gases, specify Koppers-Elex . . . *designed, engineered, built, installed and guaranteed* by Koppers . . . *with 111 years of reputation-building integrity behind it.* Koppers Co., Koppers-Elex Precipitator Dept., 239 Scott St., Baltimore 3, Maryland.

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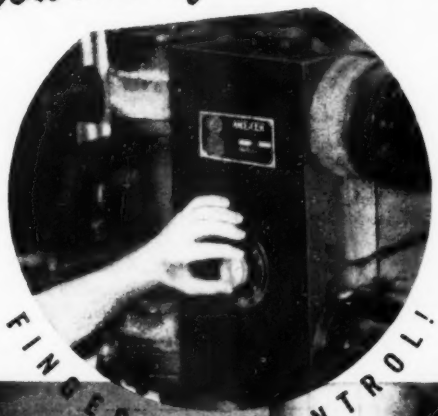

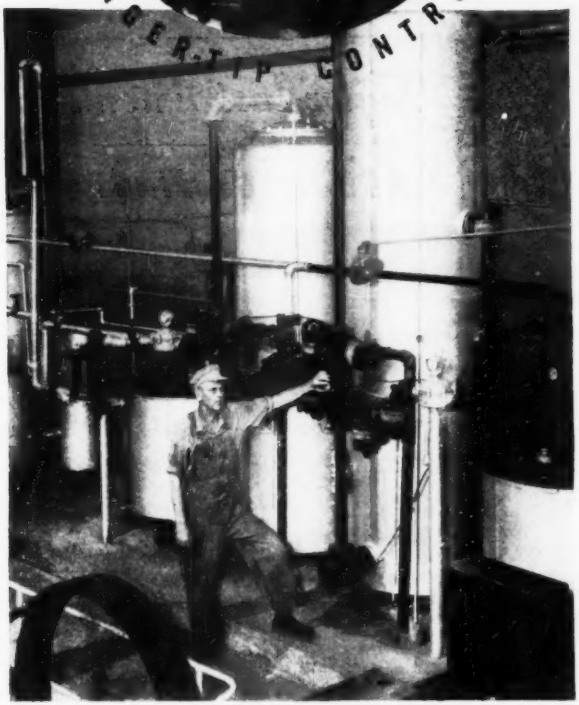

Infilco Water Demineralization Plant

SAFE, simple, fool-proof operation is assured by Infilco's *FINGER-TIP Control* for Ion Exchangers for demineralization and silica removal! Individual hydraulically operated diaphragm closure valves, pilot valve controlled, make certain tight, leak-proof closure under all conditions. Valve scoring and erosion, requiring regrinding and refitting are eliminated. And, Infilco's *FINGER-TIP Control* avoids all possibility of operational error. *It opens and closes valves in proper sequence for the necessary functions of backwashing, regenerating, rinsing and treatment.*

Remember, it takes more than just tanks and exchange materials to make a satisfactory Water Demineralizing and Silica Removal Plant! Before YOU decide on equipment of this type, be sure you get the *right* Ion Exchange Materials, conservatively rated, for the particular water to be treated. And be sure the mechanical design of the equipment will give long, trouble-free service-life. PLAY SAFE! . . investigate INFILCO *FINGER-TIP* Control. Ask for Bulletin No. 1960. Write TODAY!

INFILCO

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Don't blame your boiler for wasting steam . . .

IF too many dollars are going up in steam, don't blame your boiler. You can eliminate the extravagant waste of continuous blow-down by using a Taylor Automatic Blow-Down Control System. It can save you money seven ways.

1. **Holds feed water concentration** at desired value.
2. **Eliminates waste** of boiler feed water.
3. **Recovers heat** in blow-down water.
4. **Insures long life** of control valve. Eliminates wire drawing due to operating valve in partly opened position.
5. **Saves steam.**
6. **Saves chemicals.**
7. **Eliminates guesswork** and careless valve operation resulting from manual control.

If you have several boilers the Flex-O-Timer* Time Cycle Controller can operate more than one blow-down valve with no throttling action. Diagram below shows how it operates diaphragm valve on blow-down line. It removes soluble salts by automatically letting in or shutting off a 20-psi air supply to valve in outlet line so that it opens or closes in a definitely timed sequence.

Write for Bulletin 98149 today! It shows how this and other accurate Taylor Control Systems can cut costs for you. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

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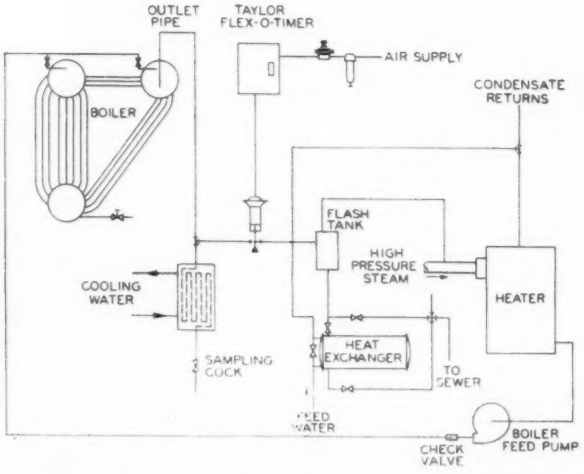
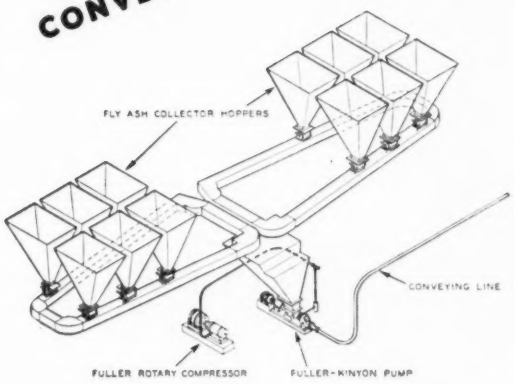


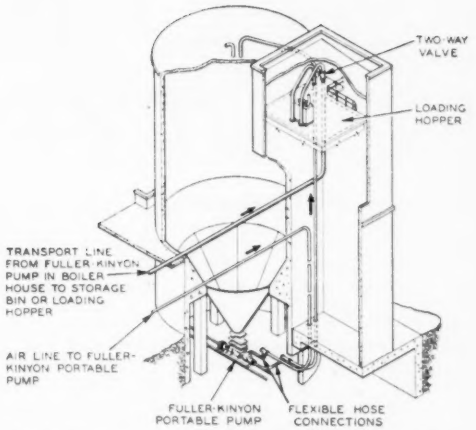
You'll be money ahead with this Taylor Automatic Blow-down Control System

Fly-Ash now an asset!

CONVEY WITH FULLER KINYON PUMPS

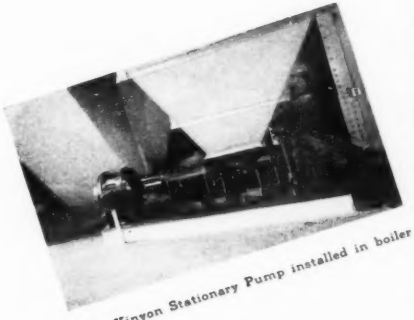


Fuller-Kinyon Pump conveying fly-ash from collector hoppers, in boiler house, to storage bin, or direct to hopper for bulk-car loading.


TWO-WAY VALVE
LOADING HOPPER
TRANSPORT LINE FROM FULLER-KINYON PUMP IN BOILER HOUSE TO STORAGE BIN OR LOADING HOPPER
AIR LINE TO FULLER-KINYON PORTABLE PUMP
FULLER-KINYON PORTABLE PUMP
FLEXIBLE HOSE CONNECTIONS

Fly-ash storage and handling facilities. Fuller-Kinyon Portable Pump for conveying from present storage bin, or future bins, to loading hopper for bulk-car loading.

CONVERT A COSTLY WASTE-PRODUCT INTO A PROFITABLE BY-PRODUCT



Fuller-Kinyon Stationary Pump installed in boiler house.

Fly-ash need no longer be considered a liability, to be disposed of by spreading it all over valuable property. You can now turn this so-called waste-product into a profitable by-product.

Several large power-generating stations are selling fly-ash to manufacturers of concrete products. It has been found that the use of this material is beneficial in the manufacture of cement bricks and blocks, concrete soil pipe, and ready-mixed concrete. Large quantities are now being purchased by manufacturers of these products.

Fuller-Kinyon Pumps are now in use in several generating stations for the clean and efficient handling of fly-ash. On this page is illustrated how a Mid-western generating station, using a Fuller-Kinyon Pump, conveys this material from collecting hoppers, in the boiler house, to either a bin for storage, or direct to car loading. A second Fuller-Kinyon Pump is also installed underneath the storage bin for conveying from storage to car-loading hopper.

Consult us about fly-ash conveying. We'll be glad to make a study of your conditions and suggest means to improve them.

FULLER COMPANY, CATASAUQUA, PA.

Chicago 3 - 120 So. LaSalle St.
San Francisco 4 - 420 Chancery Bldg.

FULLER

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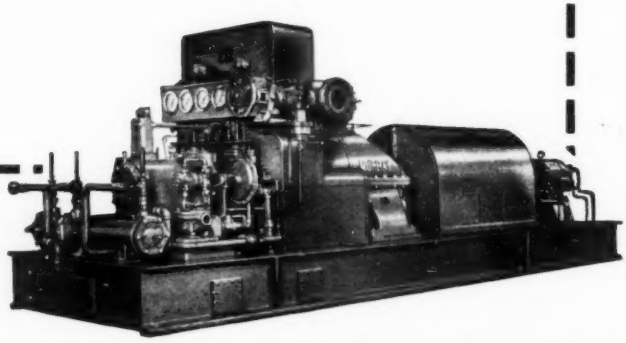
P-106

MURRAY
TYPE D
TURBO-GENERATOR



Murray Type D turbo-generators are built in a capacity range from 500-3000 KW. Turbines are either direct-connected to 2-pole generators or operate through reduction gears connected to 6-pole generators at 1200 RPM. Direct current and 25-cycle machines are also available. This type machine is regularly furnished in the above capacity range either condensing or non-condensing and may be of the automatic extraction type or for high back pressure. Units may be mounted either on soleplates or on a fabricated steel base.

This type turbo-generator is designed to operate on steam conditions up to 600#, 750° F. TT. Auxiliary equipment normally includes combined trip throttle valve, complete pressure lubrication system including oil tank, oil filter, coolers, and automatic turbine-driven auxiliary oil pump. Gauge board with gauges, vibrating reed tachometer and necessary thermometers are also furnished.

The above photograph shows a machine of this type rated at 1000 KW. Two duplicate machines are installed in our Nation's Capitol.

Murray turbo-generators have long been noted for their rugged construction, operating economy and long life with a minimum of maintenance.

Write today for full details

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Smooth bore construction with mechanical reinforcing wire within the wall of hose. Used principally for gritty, sandy, corrosive fluids.

TOWER SUCTION

Rough bore construction has exposed lining of wire and fabric. Good for heavy service but not recommended for water containing grit or fluids having corrosive properties.

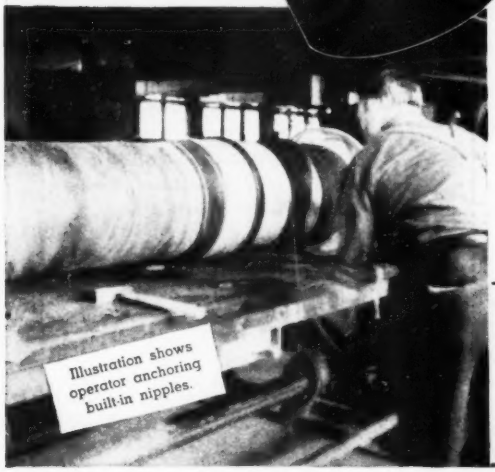

Illustration shows operator anchoring built-in nipples.

Mr. Ray L. Smith, President
Troy Building & Supply Co.
Troy, New York

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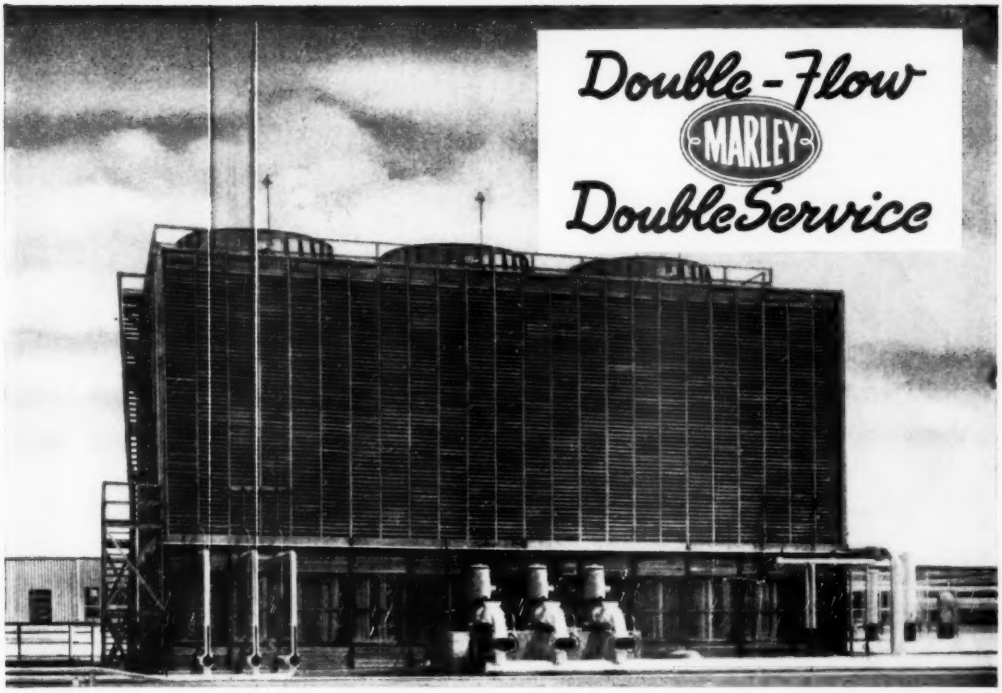

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MARLEY DOUBLE-FLOW COOLING TOWERS are built to "Take It"! For unusually heavy water cooling requirements . . . open, closed or combination cooling . . . in any kind of weather . . . and in abnormally corrosive atmospheres, the MARLEY DOUBLE-FLOW is designed to give consistent, around the clock service with a minimum of maintenance time and expense.

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COMPLETELY SAFE OPERATION... Stairways, handrails, walkways, and fan cylinders insure safe operation and maintenance in any kind of weather.

MINIMUM DRAFT LOSS . . . Drift eliminators set in slanting position allow greater area for air passage, minimizing draft loss and reducing horsepower requirements.

GREATER COOLING CAPACITY . . . Packed with decks of nail-less filling, Double-Flows have more wetted surface therefore greater cooling capacity.

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Photo by Elwood Payne

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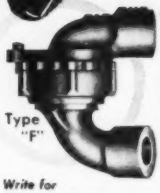

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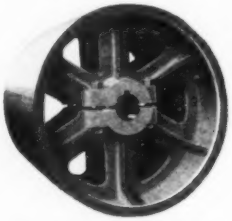
High test cast iron pulleys in all sizes and types

Completely split pulley



Extra heavy conveyor pulley

JONES cast iron pulleys are true running — they permit higher speeds — no bushings and they can't fall apart — they don't rattle and they look better on most machines.

These pulleys are machine molded, poured of high test cast iron, and are accurately finished and balanced. Multiple piece pulleys, rubber covered pulleys and flywheels can be furnished.

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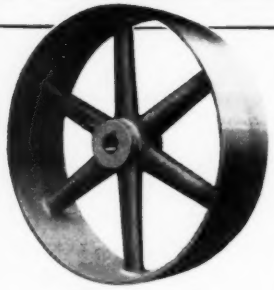
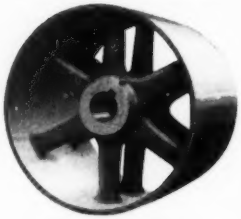


Single arm solid pulley



Double arm pulley

Jones

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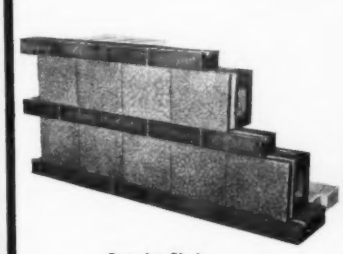
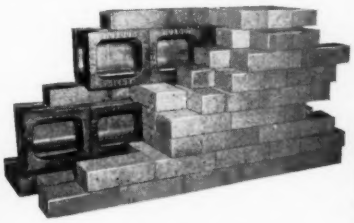
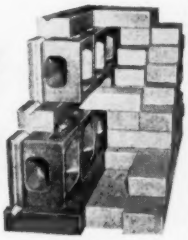


Crystolon Blocks
and Special 9" Brick Fire Face View



Rear View
Showing Hollow Block Design



End View
Showing Air Passage

CRYSTOLON

Crystolon is the Norton Company trade-mark for products made of silicon carbide. A maximum of highest quality silicon carbide and a minimum of refractory bond are used in Crystolon hollow blocks and bricks for boiler furnaces.

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(4) *Resistance to abrasion* is offered by Crystolon blocks which are made of one of the hardest substances known. A moving fire bed in a stoker-fired furnace will not wear these blocks.

Crystolon air cooled blocks are designed as a full block having a 9" base or as a half block with a 4½" base. The blocks are made with either a blank face or a perforated face having two or four holes.

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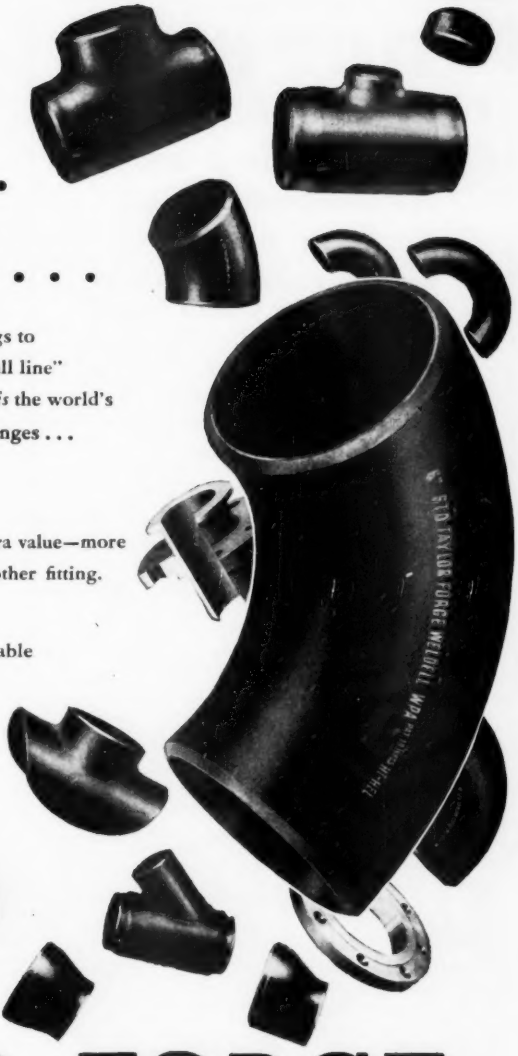

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- Flexible . . . quick response to heat expansion cuts strain on adjacent fittings and equipment
- Packless . . . single tube construction provides pressure-tight joint without packing
- Special forming methods . . . no danger of structure-weakening stresses
- Controlled heat treating . . . to assure long life for flexing member
- Directed flexing rings . . . to equalize stresses *between* and *within* corrugations
- Fabricated from stainless steel or alloys . . . joints withstand high temperature and corrosion

These features are important in any pipe line job — you can get them all only by specifying Badger Expansion Joints.

Badger

MANUFACTURING COMPANY

230-260 BENT ST. CAMBRIDGE 41, MASS.

the problem

Cracking of insulation caused by pipe expansion in high temperature work. Particularly where large pipe sizes are involved, the problem is serious as insulation may crack at practically every joint throughout the length of the pipe. Result: Greatly lowered efficiency and ultimate partial or complete reinsulation of the pipe.

the solution

Application of Unibestos sectional insulation in single-layer construction. Because of the great strength of Unibestos, sections can be readily stapled one to the other on these large pipes, thereby controlling separation of insulation. Separation is confined to one point which is easily covered by an expansion joint made from sectional Unibestos and applied as shown in illustration.

because

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2. Unibestos one-layer construction, is quickly applied. Ease of cutting, fitting, stripping, assures substantial savings in application costs.
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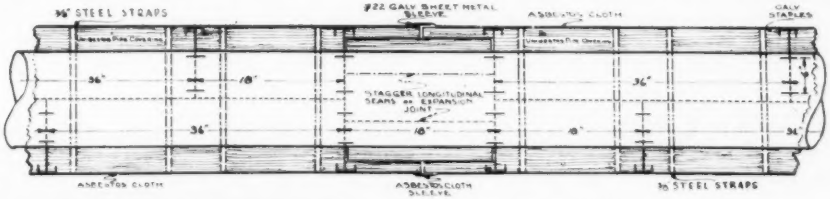
4. Unibestos is highly resistant to moisture . . . Stands up under repeated water saturation, does not split under steam pressure.
5. Unibestos can be re-used. Easy to remove and replace for pipe inspection and high salvage value on other work.
6. Unibestos with its low thermal conductivity and its high degree of resistance to shock or vibration is the ideal insulation for that *tough* job.

UNARCO **unibestos** is recommended for temperatures up to 1200 F. No. 750 is suitable for temperatures up to 750° F. No. 1200 or Combination are recommended for temperatures up to 1200° F. These temperature ranges permit the use of one material at maximum efficiency for a wide variety of purposes. Unibestos is available in half sections up to 30" pipe diameter, in quadrants up to 60" diameter, and in cylindrical form where specified. No. 750, No. 1200, and Combination are all furnished in single layer construction, but are also available in double layer construction to provide for expansion in piping, where required.



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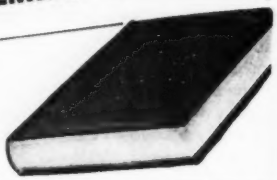

THIS book provides in compact, question-and-answer-form all the information you want on centrifugal, vertical, turbine, regenerative, rotary and reciprocating pumps. It describes each type of pump and its parts . . . analyzes operating characteristics and the application of the pump . . . explains best methods and techniques of installation and maintenance . . . gives quick solutions to pump troubles, tells their symptoms, causes and remedies.

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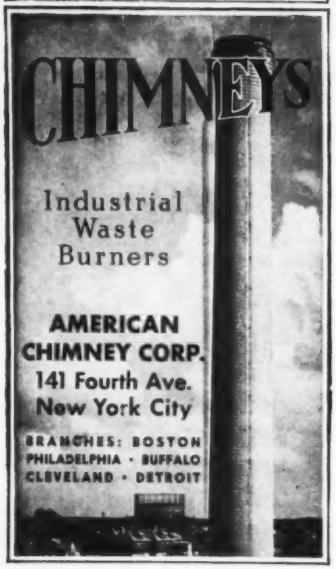

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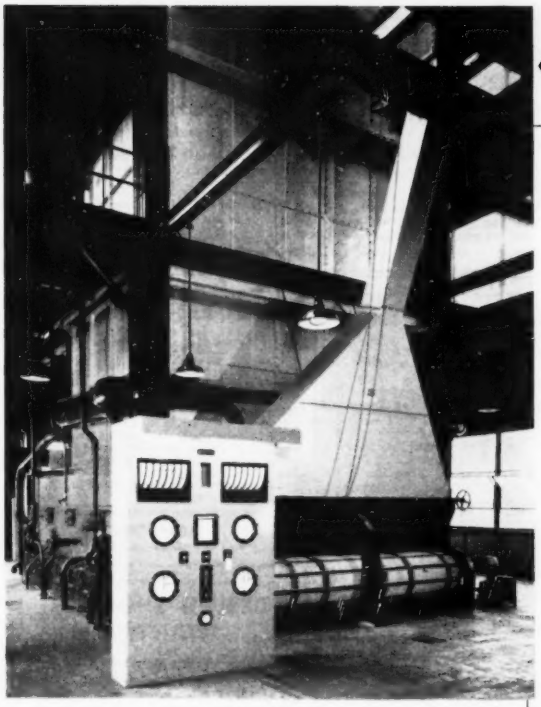
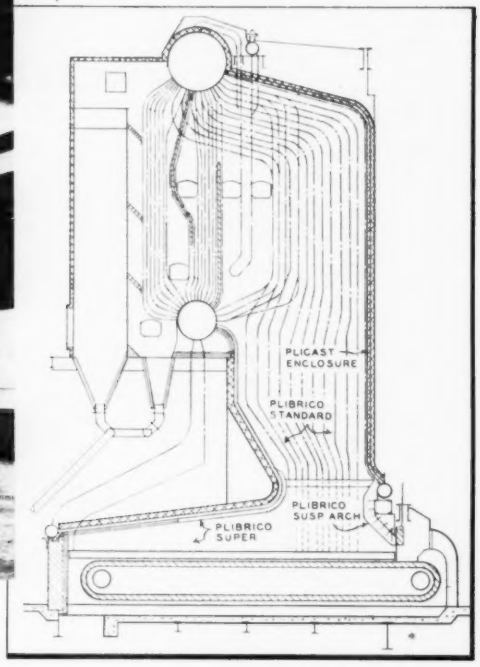


The new boiler at Central Gas Works of Public Service Electric & Gas Co. is shown at left. Print below shows longitudinal section of setting and details of Plibrico construction. United Engineers & Constructors, Inc., engineers and builders.



The PLIBRICO Story in a beautiful setting

We can't conceal a flush of extra pride as we show you this handsome and efficient unit recently installed at the Central Gas Works of the Public Service Electric & Gas Co., Piscataway town, N. J. It is a two-drum Stirling boiler rated at 100,000 lbs. steam per hr.; the stoker is a 16′ x 22′ Lloyd chain grate, Coxe type.

The furnace enclosure was constructed by the Plibrico boiler setting organization and the entire furnace, from floor line to tube deck, is Plibrico construction throughout. Side walls in the firebox are Plibrico Super. Front arch is Plibrico Super suspended arch construction; rear ignition arch tubes also covered with Plibrico Super. Side walls above the firebox are Standard Plibrico. Front and bridge wall are our tube-suspended wall construction combining Plicast castable refractory, Plisulate insulating block, and steel casing. Rear of the firebox at discharge end of stoker is Plicast No. 27. Soot hoppers are lined with Plicast No. 15.

Here is another demonstration of the scope of Plibrico refractories and service. When you need refractory work of any type, from a simple patch to a complete setting, just call on your local Plibrico Sales & Service organization and you will be pleased with the recommendations you receive. Meanwhile, write for catalog, specifying water tube or H.R.T. edition.

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RW-9304, POWER
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GOLD SEAL Engineer; State of N.J.; age 35; married; with seventeen years of practical experience in operation and maintenance of power plant equipment. Desires position with progressive firm as Chief or Assistant. PW-9726, Power.

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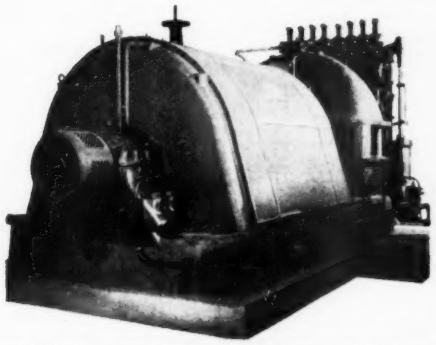

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6— 2,250-KVA., G.E., 400#, 2300-v.
7— 937-KVA., (2) G.E.-Allis, 480-v. 200#.
8— 625-KVA., (2) G.E.-200#, 480-v., 2300-v.

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H.P.	Make	Type	Speed
450	G.E. vert.	KF-633S	1180
250	L.A.	OGS-137S	1200
250	G.E.	K-568	575
200	G.E.	KF-6335Z	880
147	West.	25 cy.	1750
125	Al. Ch.	AR-630F	450
100	G.E (2)	K-544	1175
100	West.	CS	870
100	G.E.	KT-556	865
100	West. (2)	CS	690
75	West.	CS-505S	1760
75	West.	CS-662-C	1150
75	G.E. (3)	KT-372	870
75	G.E.	KT-356	690
75	West.	CS	670
60	West.	504-S	1750
60	Rel.	AA-C5084Z	870
60	West. (2)		900
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	G.E.	K-445	1170
50	West.	CS	800
40	G.E.	KT-336	900
40	West.	CS	900

Partial List Only!

Slipring Motors

H.P.	Make	Type	Speed
600	C. Wh.		514
200	G.E.	MTP	1800
200	G.E.	IM	1200
150	G.E.	MT-564Y	580
100	G.E.	IM	1800
100	Al. Ch.		690
75	G.E.	IM	870
75	G.E.	IM	690
60	Al. Ch.		690
60	G.E.	M-6326TEFC	855
50	West.	CW-554	1155
50	Al. Ch.	ARY	575
50	F-M	BY	575
50	G.E.	IM	490
40	G.E.	IM	1200

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
400	G.E. (4)	TS-9828	600
260	G.E.	TS	900
200	Ideal (2)		257
180	G.E.	ATI	900
150	G.E.	ATI	720
150	G.E.	TS	1200
125	West.	G	1200
100	Elec. Prods.		1200

A.C. GENERATORS

K.W.	Make	Type	Speed
288	West.	G	900
187	West. (2)	G	514
75	G.E.	ATB	360
75	G.E.	ATB	1200

D.C. to A.C. Generators

K.W.	Make	D.C.	A.C.
25	G.E.	230	220
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El. Spec.	110	110

550 V. D.C. Motors

H.P.	Make	Type	Speed
765	G.E. (6)	MPC	1045/1350

230 V. D.C. Variable Speed Motors

H.P.	Make	Type	Speed
100	Rel.	1050-T	400/1200

230 V. D.C. Variable Speed Motors *(Continued)*

H.P.	Make	Type	Speed
75	G.E.	D	500/1500
75	Cr. Wh.	CMC-125H	375/750
60	G.E.	C	480/1100
55	Cr. Wh.	CCM-125H	165/500
50	West.	SK	250, 1000
50	West.	SK	500/1500
50	G.E.	RF-17	475/950
40	Rel.	461T	400/1200
40	G.E.	CD-1441	400/1500
25	West.	SA	500/1600
25	Rel.	185-T	500/1500
25	G.E.	RF-13	400/1800
25	G.E.	RF-14	400/1200
25	G.E.	RF-14	300/1200
20	G.E. (6)	RF-12	400/1200
20	West.	SK	375, 1500
15/20	Rel. (4)	185-T	400/1600
15	West. (4)	SK-95	600/1500
15	F.D.		500/1500
15	West.	SK-12	350/1000
15	West.	SK	250/1000
15	West.	SK	500/1500
10	G.E.	RF-10	600/1800
10	G.E.	CD-83	600/1800
10	West.	SK	600/1200
10	West. (3)	SK	500/1500
10	G.E.	RF	400/1600
10	G.E. (3)	RF	400/1200
10	Rel.	131-T	250, 1030
7½	West.	SK-70	500 1500
7½	G.E.	RF-10A	450/1600
7½	Al. Ch.		350/1050
5	West. (3)	SK-60	500/1500
5	G.E.	RF-9	450/1800
5	G.E.	RF	450/1800
5	Rel. (2)	46-T	400/1600

230 V. D.C. Motors

H.P.	Make	Type	Speed
150	G.E.	RC-19	800
125	G.E.	RC-15	1750
100	G.E.	RC-14	1750
100	Al. Ch.		1200
75	West.	SK-170	635
75	West. (2)	SK-180	475
75	Cr. Wh.	52-HM	480
60	West. (2)	S-160	680
50	G.E.	RC-12	1750
50	West.	SK-133	1300
50	Diehl	K-10	850
50	West.	SK	750
50	West. (2)	SK-160	585
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC	1750
40	G.E.	RC-32	1100
40	G.E.	RC-13	1075
30	G.E. (2)	RC	1200
30	West. (2)		975
30	G.E. (2)	RC-33	775
30	West. (2)	SK-143	575
20	G.E. (2)	CD-83	1750
20	G.E. (2)	RC-11	1150
20	Star (2)	SR-316	29.2

115 V. D.C. Motors

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr. Wh.	CMC	900
25	G.E. (2)	CD	1800
25	Cr. Wh.	CCM	750
20	Century	RS	1750
20	G.E. (2)	CD-83	1750
20	West.	SK-110L	750
12½	G.E.	CDM-85	930/1160

600 V. GENERATORS

KW	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150
20	G.E.	1750

250 V. GENERATORS

KW	Make	Speed
1000	G.E.	900
500	West.	1100
330	Elliot	1200
300	G.E.	1200
300	Al. Ch.	1200
300	West.	900
300	West.	1200
200	G.E. MPC	1200
150	West.	900
150	West.	1150
150	G.E.	600
100	Hertner	1200
75	G.E.	1750
50	G.E.	1200
40	Reliance (4)	1750
30 (3)	G.E.	1750
30	Cont.	1200
25	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V. Generators

KW	Make	Speed
250	G.E.	720
150	Cr. Wh.	1200
150	West.	1150
100 (2)	West.	900
100	G.E.	1200
100	El. Machry.	1200
75	Cr. Wh.	1200
75	Hertner	1150
50	Sturt.	2800
40	Cent.	1450
30	Ideal (2)	1750
30	G.E.	1150
30	L.A.	1450
25 (2)	El. Mchy.	1150
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

Low Voltage Generators

Amp.	Make	Voltage
8000	H-V-W.	6/12
5000	Optimus	6/12
1500	H-V-W.	6/12
1000	Cal.	6/12
125	Hobart (8)	7½
300	Star	15
67	Cont.	15
750	Star	15
1000	G.E.	15
800	G.E.	22/23
600	Rel.	24
134	West.	24
175	Cr. Wh.	25
550	Col.	27
1600	G.E.	30
800	G.E.	30
100	G.E.	30
200	West.	30

Low Voltage Gen. (Cont.)

Amp.	Make	Voltage
205	G.E.	32
1000	G.E.	34
500	Chandeysaen (2)	40
1000	Chandeysaen (2)	40
205	G.E.	42
24	G.E.	44/54
75	G.E.	50/10
800	G.E.	50

Transformers

4—333 KVA Maloney 2300/4600 Primary 220/440 Secondary

300 KVA—Al. Ch. 3 phase, 4160 V. primary, 230 V. secondary.

300 KVA—Pittsburgh, 3 phase 4160 V. primary, 230 V. secondary.

50 KVA—(2) G.E.-H-KF 2400/4160 Y-122/40 V.

New D.C. Starters

150—230 V. Magnetic 5 H.P. to 75, H.P. G.E., C-H, A-B, W.L. etc.

100—230 V. Manual and Compound 1 H.P. to 5 H.P.—G.E. & C-H.

40—7½ H.P. 230 V. C-H—magnetic reversing.

A.C. Starters

1—475 H.P. West. Magnetic Reduced voltage, 550 V. syn.

4—400 H.O. C-H Bul. 9976 440 volt. Magnetic red. volt. synchronous.

1—250 H.P. C-H. 4150 V. synch. full voltage.

1—150/200 H.P. G.E.—440 V. CR-7065 synch.

3—150 H.P. GE 220V-CR 7061 synch.

2—150 H.P. West. Class 11400-440-V Auto. Resistance.

New A.C. Starters

40—C-H & A-B 2 and 4 speed Magnetic up to 25 H.P.

20—50 H.P. C-H 440 V. Magnetic.

165—20 H.P. W.L. 440 V. Magnetic.

635—7½ H.P. C-H 440 V. Magnetic.

Air Compressors

425 Cfm. Sullivan 2 stage

360 Cfm. American 125 lbs.

Electric and Air Hoists

17—2 ton Shepard-Niles, 230 V. D.C.

8—500 lbs. P. & H. Zip Lift, 3 phase.

1—2 ton Thor, pneumatic.

1—½ ton, Thor, pneumatic.

400 Cy. Gen.

1—3 KW G.E., 3 ph. 110 volt.

1—7½ KW G.E. 3ph. 400 cy.

1—10 KW G.E., 200/700 cycle.

1—15 KW G.E. 3ph. 400 cy.

EST. 1910 — L. J. LAND INC. — 40th YEAR

156 GRAND STREET — Phone CAnal 6-6976 — **NEW YORK 13, N. Y.**

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411 Atlantic Ave., BOSTON, MASS
Phone Liberty 2-4300

South Western Representative
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Pennsylvania Office
10th and Exeter Sts., READING, PA.
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Our 43rd Year

WAGNER

Quality and Service

"CERTIFIED REBUILT"

DEPENDABLE ELECTRICAL EQUIPMENT AT LOW COST

MOTORS . . . GENERATORS . . . M-G SETS

PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS

PARTIAL STOCK LISTING—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

250 KW Allis-Chalmers M-G Set. DC 120/240V. output, 363 H.P. Synch. Motor, 3/60/440V. 1200 RPM, AC & DC panels, late model, imm shipment.

M-G SETS

KW	Mfr.	Input V	Output V
450	Gen. Elec.*	2300 AC	275 DC
300	Allis Ch.*	220/440 AC	250 DC
250	Allis Ch.*	440 AC	120/240 DC
200	Gen. Elec.*	2300 AC	250 DC
200	Ridgeway*	2300/4000 AC	550 DC
200	Gen. Elec.	220/440 AC	125/250 DC
150	Cr. Wheeler*	220/440 AC	250 DC
105	Century b.b.	220/440 AC	70 DC
100	Gen. Elec.*	220/440 AC	250 DC
100	Gen. Elec.*	220/440 AC	125 DC
75	Gen. Elec. (2)	220/440 AC	125 DC
50	Gen. Elec.	220/440 AC	250 DC
50	Gen. Elec.	220/440 AC	125 DC
40	Gen. Elec.	220/440 AC	120 cycle
40	North'n Conv.	220 AC	230 DC
37½	Whse.	230 DC	240/480 AC
35	Gen. Elec.	220/440 AC	48 DC
30	Gen. Elec.	220/440 AC	250 DC
30	Elec. Prod.*	220/440 AC	50 DC
20	Whse.	220/440 AC	250 DC
15	Gen. Elec.	220/440 AC	125 DC
10	Allis Ch. (2)	220/440 AC	250 DC

*Synch. motor dr ve.

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	450/900
100	Gen. Elec.	C	230	575/1000
75	G.E. New b.b.	CDM	230	1755
75	Cr. W. New b.b.	CMC	230	1150
75	Allis Ch.	E	230	500
75	Whse.	S13L	115	570
75	Gen. Elec.	BRC	115	1150
75	North'n	K20	230	1750
60	Gen. Elec.	RC36	230	650
60	Elec. Dyn.	25-S	230	450/900
50	Allis Ch.	E131	230	850
50	Gen. Elec.	RC32	230	1100
40/80	Whse. (2)	SK170	230	500/1000
40	Sprague dyna.	LC	230	750/2000
40	Gen. Elec.	RC32	230	1150
40	Gen. Elec.	CD113	230	850
35/80	Gen. Elec.	CD123	230	575/1150
35	Ideal	DV350	230	400/1200
30	Whse. (2)	SK93	230	1750
30	Whse.	S-7	115	900
30	Gen. Elec.	RC31B	230	1150
25	Sprague dyna.	LC	230	750/2000
25	Chandson (4)	C13	115	850
25	Gen. Elec.	CD85	230	1750
20	Gen. Elec.	RF12	230	400/1600
20	Whse.	SK93	230	1150
20	Reliance	T	230	850
20	Gen. Elec.	CD85	230	1150
20	Whse.	SK130	230	500/1500
15	Whse. (3)	SK90	230	825
15	El. Dyn. b.b.	320	230	1750
15	El. Dyn. b.b.	18S	230	300/1200
15	Whse. (2)	SK80L	230	1150
15	Star b.b. (4)	SQ	230	1200
15	G. E. TEFC bb	CDS3	230	1750

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	250	1200
105	Century b.b.	1500 amp.	70	1200
100	Gen. Elec.	RC17	125	1200
100	Gen. Elec.	C	250	750
75	Allis Ch.	E	250	750
75	Whse.	S	125	600
75	Cr. Wheeler b.b.	CCD	250	1450
75	Gen. Elec. (2)	RC36	125	1200
50	Gen. Elec.	RC36	250	850
50	Gen. Elec.	RC	250	1250
40	Gen. Elec.	RC32	250	1450
30	Elec. Prod.	BP	50	1150
30	Gen. Elec.	RC	250	1500
20	Reliance	T	250	1150
15	Star b.b. (3)	late	250	1750

EXPLOSION PROOF MOTORS

from 1 to 20 H.P. . . . . std. speeds

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
150	Whse.	HF	440	500
150	Gen. Elec.	1K-16	440	750
50	Allis Ch.	ANY	440	750
50	G.E. int.	MTC5337	440	750
50	G.E.	I-K	440	750
50	Gen. Elec.	KT339	440	1500
40	Gen. Elec.	KT343	440	750
20	Gen. Elec.	KT527	440	750
15	Whse. TEFC	CS365	220/440	1500
15	Reliance TEFC	C444	220/440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	360
300	Gen. Elec.	ATB	240/480	720
250	Whse.	G	2300	600
200	Gen. Elec.	ATB	240/480	600
187	Gen. Elec.	ATB	240/480	900
150	Gen. Elec.	ATB	2300	450
150	Gen. Elec.	ATB	240/480	900
125	Gen. Elec.	ATB	240/480	300
100	Gen. Elec.	ATB	240/480	900
100	Gen. Elec.	ATB	240/480	1200
75	Gen. Elec. New b.b.	AT17552	240/480	1200
56	Gen. Elec (2)	ATB	240/480	1200
56	Gen. Elec.	ATB	240/480	900
34	Gen. Elec.	ATI17336	240/480	1200
25	Whse. b.b.	1 ph.	120/240	900
12½	Whse. b.b. NEW		240	1200

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	500	Allis Ch.	ANY	450
2—	300	Allis Ch. 2200 V.	ANY	720
1—	300	G.E. 2200 V.	I-M	1800
1—	300	Whse. 2200 V.	CW	600
1—	250	G. E. 2300V	MT	300
1—	200	Gen. Elec.	I-M-17	600
1—	200	Gen. Elec.	IM-17A	450
1—	150	Whse.	MW	450
1—	150	G.E. 2200/4000 V.	I-M	1200
1—	150	Allis Ch.	ANY	600
1—	150	Gen. Elec.	IM-15A	720
1—	100	Allis Ch.	ANY	1800
1—	100	Al. Ch. b.b. NEW	ARY	600
1—	100	Allis Ch.	ANY	720
1—	100	Whse. int. 2200 V.	C1856C	600
1—	100	Whse. int.	CI-756A	720
1—	100	Fair. Morse b.b.	HV	900
1—	75	Gen. Elec.	I-M-E13	1200
2—	75	Gen. Elec.	IM-14	720
1—	75	G.E. int. duty	MTC5342	900
1—	75	Ideal int.	AVE	1200
1—	75	Gen. Elec.	MT558	600
2—	75	Gen. Elec.	IN-14	600
1—	75	Gen. Elec.	MT337	1800
1—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Fair. Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	CI	600
1—	50	Gen. Elec.	I-M	720
1—	40	Gen. Elec.	MT336	900
1—	37	G.E. int.	ITC	600
2—	30	Gen. Elec.	MT526	1200
1—	30	Gen. Elec.	OMT336	1200
1—	30	Gen. Elec.	MT346	600
2—	25	Gen. Elec.	MT332	900
1—	25	Triumph	SR	1200
1—	25	Gen. Elec.	I-M	600
1—	20	Gen. Elec.	MT503	1800
1—	20	Gen. Elec.	MT326	900
1—	15	P & H b.b. int.	W7	1200
12—	10	Reliance New b.b.	AW-324	1800

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
300	Gen. Elec.	AT1	220/440	720
300	Whse.	G	2200/440	600
250	Ideal	2BC-M4	2300	450
220	G.E. 3 brg. .8 PF	ATI	220/440	600
200	G.E. .8 PF	ATI	220/440	900
150	Gen. Elec. .8 PF	ATI	2200	450
150	Gen. Elec.	ATI	220/440	300
125	G.E. spiprf. .8 PF	TS955	220/440	1200
125	Gen. Elec.	ATI	220/440	900
100	American b.b.	YGH	220/440	900

A. C. MOTORS—SQUIRREL CAGE

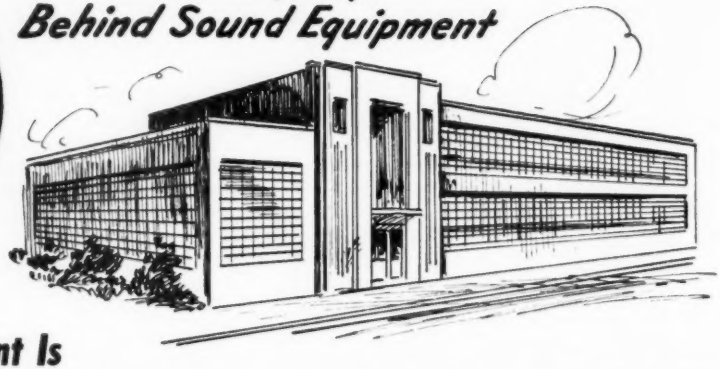
3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	400	Whse. 2200V.	CS	1800
1—	300	Gen. Elec.	1K-18	1200
1—	200	Reliance b.b. NEW	C5085	1800
1—	200	Allis Ch.	AN	1200
1—	150	Gen. Elec.	I-K-16	600
1—	150	Whse. 2200 V.	CS771-1C	1800
1—	150	Reliance b.b. NEW	B6085	1200
1—	150	Gen. Elec.	1K-15	900
1—	125	Reliance b.b. NEW	C5085	1200
2—	125	Allis Ch. 2200 V.	AN	1200
1—	125	Gen. Elec.	1K-16	450
1—	125	Cont. 2200 V. b.b.	SC	1800
1—	125	Gen. El.	KT339	3600
2—	125	Rel TEFC NEW	B6085	1800
1—	100	Gen. Elec.	I-K	1800
5—	100	Allis Ch. 2200 V.	AR226	1200
1—	100	Reliance b.b. NEW	C5085	900
1—	100	Elec. Machy.	b.b.	1200
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	G.E. b.b. NEW	K5048	1800
1—	100	Cont. TEFC	NP6082	1200
1—	100	Gen. Elec.	1K-15	720
2—	75	Gen. Elec.	1K	600
1—	75	Gen. Elec.	I-K 14	720
1—	75	Reliance b.b. NEW	C5084	900
1—	75	Gen. Elec.	KT552	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen. Elec.	KT329Y	3600
2—	75	Reliance b.b. NEW	C505	1200
1—	75	Gen. Elec.	KT347	1200
1—	60	Gen. Elec.	KT552	720
1—	60	Gen Elec.	KT346	900
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Rel. TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
2—	60	Whse. H.T.	CS804	1800
1—	60	Wagner b.b.	R-7444	3600
1—	50	Whse. b.b. NEW	CS4058	1800
1—	50	G.E. NEW b.b. HT	KG4605	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen. Elec.	KT336	1200
1—	50	Gen. Elec.	KT342	900
1—	50	Whse. hiplip	WL607	900
2—	50	Whse. b.b.	CS504	1200
2—	50	Gen. Elec.	KT352	600
1—	40	Gen. Elec. b.b.	KT4048	3600
2—	40	Gen. Elec.	KT527	1800
1—	40	Al. Ch. 3 speed	ARX 900/600/450	
4—	40	Gen. Elec.	KT336	900
2—	40	Reliance b.b. NEW	C404	1800
2—	40	Rel. TEFC NEW	C445	1200
3—	40	G.E.	KT532	1200
2—	35	Gen. Elec.	I-K	720
2—	30	Howell b.b. speed	SC	1800
3—	30	G.E. NEW b.b.	K3465	1800
2—	30	G.E. NEW hiprp	KG365	1800
3—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT336	720
1—	30	Wagner	22T8P	900
1—	30	Whse.	CS3649	900
2—	30	Reliance b.b. NEW	C405	1200
2—	30	Reliance TEFC NEW	C444	1200
1—	30	Cr. Wheeler b.b.	SC30Y	1800
2—	25	Gen. Elec.	KT326	1200
2—	25	Rel. TEFC NEW	C444	900
3—	25	Reliance b.b. NEW	C364	1800
2—	25	Reliance TEFC NEW	B365	1800
2—	25	Reliance b.b. NEW	C404	1200
2—	25	Reliance TEFC NEW	C405	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
3—	25	Whse.	CS646	900
2—	25	Gen. Elec.	I-K	600
1—	20	Reliance b.b. NEW	C404	900
1—	20	G.E. TEFC b.b.	K404	1200
4—	20	Reliance b.b. NEW	C364	1800
2—	20	L.A. NEW exp. prf.	EX364	1800
2—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
1—	20	Whse.	CS	1200
2—	20	G.E. NEW b.b.	K365	1200
2—	20	Diehl TEFC NEW	INF364	1800
2—	20	Century b.b. 4 speed	SC594	1800
4—	15	G.E. NEW b.l.	K324	3600
1—	15	Gen. Elec.	KT512	900
2—	50	Whse. b.b.	CS504	1200

ARTHUR WAGNER COMPANY

1435 W. RANDOLPH STREET CHICAGO 7, ILL. MONroe 6-7409

A Sound Company Behind Sound Equipment



Where Hemphill Electrical Equipment Is REBUILT — THEN TESTED BY ELECTRICAL ENGINEERS

NO ITEM OF HEMPHILL REBUILT EQUIPMENT IS SHIPPED TO THE BUYER UNTIL TESTS PROVE THAT IT WILL GIVE YOU PERFECT SERVICE

TRANSFORMERS

1—1000 KVA G.E., 3 Ph. auto 4150V.—2300V.
1— 500 KVA Kuhlman 4150 V Pri. 2300 V. Sec.
3— 400 KVA G.E., 6900 Primary—2300 Secondary
2— 300 KVA Pitts., 2300 V. Pri., 115/230 V. Sec.
3— 300 KVA, G.E., type H, 2300 V Pri., 115/230 V. Sec.
300 KVA, Pitts., 7800-440 v.
295 KVA, Whse., 2 ph., 2300 to 3 ph., 4150 auto.
200 KVA, 4000 v.—110/220
100 KVA, Pitts., 1375/2750 v. — 110/220.
3— 100 KVA G.E. 4150 volt 230/460 volt Pyranol
3— 100 KVA, Wagners, 240/120 v.—120 v.
2— 100 KVA, Newark, 440 v., 3 ph. to 220 V., 2 ph.
2— 100 KVA, Whse., 12800 v. to 250 v.
3— 75 KVA, G.E., 2400 v.—120/240
6— 50 KVA, Whse., 2400 v.—120/240 Imerteen
6— 50 KVA Whse., 13,800 v. to 125 v. or 250 v.
6— 50 KVA, Whse., 6900 v. to 125 v. or 250 v.

A. C. GENERATORS

2500 KVA, Whse., Syn. Cond., 720 RPM, 2400 v.
500 KW, .8 P.F., 3600 RPM, ATB, 600 v.
320 KW, Allis, 450 RPM, 480 v.
240 KW, G.E., ATB, 600 RPM, 600 v.
200 KVA, Allis, 3600 RPM, 240 volt
200 KVA, Whse., 600 RPM, 240 v.
180 KW, Whse., 514 RPM, 550 v.
100 KW, G.E. ATB, 600 RPM, 240 v.
75 KW, Whse., 900 RPM, 220 v.
62½ KW, Allis, 3600 RPM, 220 v.
7— 50 KVA, Whse., 900 RPM, 220 v.
3— 35 KWA, Columbia, 1200 RPM, 240 v.
1—31.3 KVA, America, 1200 RPM, 120-208.
15 KW, Star, 1800 RPM, 220/440
12.5 KVA, Whse., 1200 RPM, 240 v.

TURBINE BLOWERS

1—Spencer, 1000 cubic feet, 30 oz. pressure with a 15 H.P., 3600 RPM, General Electric Type FT 200 volt motor
1—Bellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P. 3600 RPM. General Electric, Type K, 220 volt 3 phase motor.

MOTORS, 3 Phase, 60 Cycles SQUIRREL CAGE

450 H.P., Ridgeway, 900 RPM, 2200 volts.
125 H.P., G.E., KF, 1750 RPM, 2200 v.
125 H.P., U.S., 1200 RPM, Vert., 220 volts.
100 H.P., G.E., 400 RPM, 440 volt.
75 H.P., West., CS, 1750 RPM, 440 volts.
60 H.P., Whse., 900 RPM, Vert., 2200 volts.
60 H.P., Whse., 900 RPM, 440 volts.
2— 40 H.P., G.E., 900 RPM, 220 volts.
40/20 H.P., Westinghouse 600/450 440 volt.
25 H.P., Whse., 1200 RPM, CS, 2200 volts.

MOTORS, 3 Phase, 60 Cycles SLIP RING

2500 H.P., G.E., 257 RPM, 6600 volts.
450 H.P., G.E., 425 RPM, ITC, 440 volts, 25 cycle.
2— 150 H.P., G.E., 1M, 440 volt, 450 RPM.
100 H.P., G.E., 1M, 440 volt, 25 cycle, 720 RPM.
1— 100 H.P., G.E., 1M, 440 V. 600 RPM.
75 H.P., Whse., CW, 720 RPM, 440 volt.
75 H.P., G.E., MT, 1200 RPM, Vert.
50 H.P., G.E., MT, 600 RPM, 220 volt.
2— 50 H.P., Whse., CW, 900 RPM, 220 volts.
10 H.P. Cont., 1200 RPM, JA85 220 volt.

AIR COMPRESSOR

312 CFM, I-R Model 75, 2 stage, 900 RPM, 100# with 75 H.P. Squirrel Cage Mtr.

DIESEL GENERATOR SETS

3—300 KW 125/250 V. De La Vergne Baldwin 6 cyl. 4 cycle with Westinghouse generators

LARGE STOCK OF D. C. MOTORS AND GENERATORS SYNCHRONOUS MOTORS

4—200/100 H.P., Whse., 720/360 RPM, 4150 v.
200 H.P., Whse., 600 RPM, 240 v.
1—200 H.P., G.E., 257 RPM, 440 volt.
1—150 H.P., G.E., 1800 RPM, 220 v., TS
2—150 H.P., Allis-Chalmers 360 RPM, 2200 V.
75 H.P., G.E., 1200 RPM, 440 v.
70 H.P., Elect. Mach., 180 RPM, 2200 v.
40 H.P., Whse., 1800 RPM, 220 v.
35 H.P., G.E., 1200 RPM, 2200 v.
20 H.P., Whse., 1800 RPM, 220 v.

MOTOR GEN. SETS

1—1000 KW, Whse., 275 V.—4150—720 RPM, Syn.
1—1000 KW, G.E., 600 volts—4150—514 rpm, Syn.
1— 400 KW, G.E., 250 V, 900 RPM, 2300 V, Syn.
1— 500 KW, G.E., 575 V, 900 RPM, 2300 V, Syn.
125 KW, CW, 125 v., 1200 RPM, 2300 v, sq. cage.
100 KW, El. Mach., 125 v., 1200 RPM, 4150 v, syn.
100 KW, G.E., 230 v., 900 RPM, 4150 v, Syn.
2— 75 KW., G.E., 125 v., 1200 RPM, 220/440 v.
6— 75 KW., G.E., 60 v., 1200 RPM, 220/440 v.
50 KW., Ridgeway, 550 v., 1200 RPM, 220 v.
25 KW., G.E., ATI, 1800 RPM, 40 HP, 1800 RPM, 230 v.

PLATING M.G. SETS

250 Amp. G.E., 5/6 volt, 220 v.
500 Amp., Hansen Van Winkle, 24 volt, 220/440 v.
2500 Amp., Chandeysson, 6/12 v., 400 RPM, Syn., 440 v.
3000 Amp., Chandeysson, 6/12, 400 RPM, syn., 440 v.

ENGINE GEN. SETS

150 KVA, G.E., Ames Uniflow, 220 v., 3 ph., non cond.
2 — 5 KW, Gasoline, Hobart, 1800 RPM, 120 v., 1 ph. cont. engines.
1—200/275 H.P., Gasoline Engine, Van Blerck, 8 cylinder, 1500/900 rpm.

TURBO GEN. SETS

625 KVA, Whse. 2400 v., 3 phase, non-cond.
300 KW, G.E., ATB, 240 v., 3 ph. cond.
60 KW, Whse., 120 v., D.C., cond.

STEAM TURBINES

500 HP., G.E., 3 stage, 165#, 3240 RPM.
800 HP., Terry Tandem type, 720 RPM. red. gear

A GUARANTEE IS NO BETTER THAN THE COMPANY THAT GIVES IT — IT PAYS TO GET A *HEMPHILL* GUARANTEE

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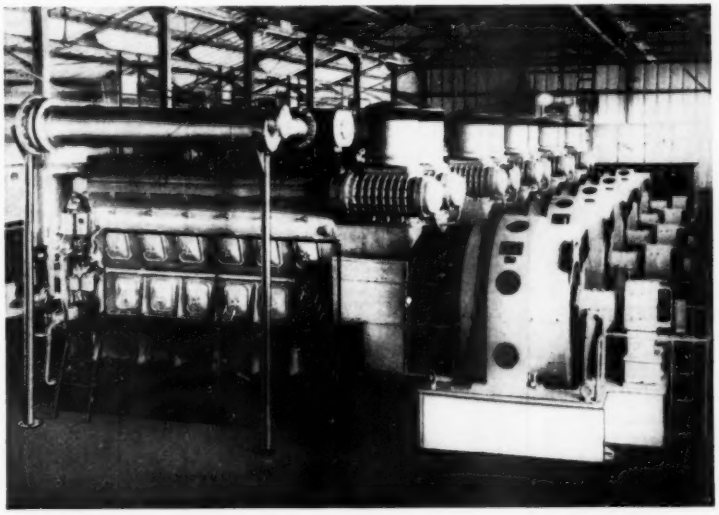
PHONE NEW YORK—LONGACRE 5-522

PHONE NEW JERSEY—UNION 3-2600

Another AGSCO DIESEL POWER INSTALLATION

FIVE 720KW GMC UNITS "ON THE LINE" IN ENGLAND



Remanufactured and Tested at Our SAUSALITO (San Francisco) CALIF. Shops, These Five 1080BHP GMC Model 12-567 Diesel Engines Connected to 900KVA, 720KW G.E. Generators Are in Continuous Service at the Parkinson Strip Mining Co. Ltd., Bedington, ENGLAND.

Save on Initial Acquisition Costs with "AGSCO REMANUFACTURED DIESEL EQUIPMENT." Submit Your Power Requirements Today.

UNITS AVAILABLE FOR IMMEDIATE SHIPMENT

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1420	Fairbanks Morse	38D8⅛	1600	720	312	General Motors	8-268A	450	1200
1250	General Motors	16-278A	1600	720	200	Buckeye	80	240	600
1000	General Motors	12-278A	1200	720	187	Ingersoll Rand	S	225	514
937.5	General Motors	12-567	1080	720	156	Buckeye	E	187	400
625	Alco	6-12½x13T	750	600	125	General Motors	3-268A	150	1200
625	Baldwin	VO-8	750	514	75	General Motors	6043C	90	1200
625	Superior	OS	750	327	75	Fairbanks Morse	35E	90	450
425	Baldwin	VO-6	510	450	62	Int'l. Harvester	UD-18	76	1200
400	Buckeye	80	480	600	50	General Motors	4-71	60	1200
375	Enterprise	DSG-6	450	450	18	Int'l. Harvester	UD-6	22	1200

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER *Company, Inc.*

ESTABLISHED 1898

Diesel Engines • Power Machinery

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REBUILT IN ACCORDANCE WITH N.I.S.A. STANDARDS

RE NU BILT — BELYEA — MOTORS

SUCCESSFUL OPERATION GUARANTEED

MOTOR GENERATOR SETS
3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	580	275	2200/4000
1	1250	G.E.	600	275	2300
1	1000	Whse	900	600	2300/4150
1	1000	Whse	720	600	2300/4150
1	1000	West.	514	250	4150
1	1000	Whse.	514	600	4150
1	800	G.E.(3U)	1200	120/240	2300
1	750	Whse	900	250	2300
1	500	G.E.	720	600	2300/4150
1	500	G.E.	720	125	2300/4000
2	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	350	G.E.	900	125	2300/4150
1	300	G.E.	1200	250	440
1	150	G.E.	1200	250	550
1	150	Cr. Wh.	1200	250	440
1	140(3U)	Cr. Wh	690	125/250	2300
1	100	G.E.	1170	125	220
1	75	Cr. Wh.	1170	250	220/440
1	75	Cr. Wh	1200	250	550

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4140	600
1	4000	G.E.	TSC	2400/4800	900
1	3000	Whse.		4000	720

ROTARY CONVERTERS
60 Cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—2000	G.E.	600	600	13800
1—2000	G.E.	450	600	2300
1—1000	Whse.	900	600	11000
1—750	Whse.	900	600	13200
1—500	Whse.	900	240	2300

FREQUENCY CHANGER SETS

1—1000 KW—Al. Ch. Consisting of 1400 HP, 2300 V. 3 ph. 25 cy. Motor and 1000 K, 2300 V. 3 ph. 62½ cy. gen. switch exciter.

1—1000 KW—GE—2 unit—3 Brg. Consisting of 1400 HP—4400 V., 3 ph. 25 cy. Motor and 1000 KW—2300 V. 2 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—320 KW GE 2 Unit 3 Brg. consisting of 600 HP 440 V., 3 ph. 60 cy., 8 pf. Syn. Motor and 400 KVA, 8 pf. type AT—3 ph, 120 cy, 720 volt AC generator with direct connected exciter.

SPECIAL—MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V., D.C. Form C with 2300 V., 60 cycle transformer and switching equipment.

1—1000 KW—American B.B. Type GRZ-612—12 anode 625 V.D.C. with 1040 KVA O15C—3 phase—13200/6600V-25/60 cycle transformer with full automatic switching equipment along with 2 distribut on panels.

1—1000 KW—Al.Ch. type B-612—12 anode 625 V.D.C. with 1140 KVA O15C—3 phase—13500V.—60 cycle transformer with manually operated switching equipment along with voltage regulator and grid control.

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1750	Whse		600	525/720
2—1500	Whse.		525	600
1—1200	Whse.		600	425
1—800/1000	Whse.		450	600/720
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	230	115/145
1—600	Al. Ch	MILL	230	400/800
1—300/400	G.E.	DYNA	250	1325/2300
1—335	Whse.	MQ	250	300/900
1—200/300	G.E.	MPC	230	360/920
1—275	Whse.	QM-600-6	230	425/850
1—250	G.E.	MPC	230	400/500
1—230	Al. Ch.		230	700
1—150	G.E.	MPC	230	250/450
1—150	Cr. Wh.	CCM	230	300/1050
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	230	800
1—150	Cr. Wh.	CMC-65H	230	1150
2—125	G.E.	CO-1832	230	625
1—125	El. Dy.	308	230	750/1500
1—115	Cr. Wh.	JHL	230	1200
3—101	Whse.	8K	230	485/950
1—90	G.E.	CDM-1242Z	115	1800
1—50/100	G.E.	CD-175	230	365/730
2—80	El. Dy.	308	230	475/1750
1—75	Cr. Wh.	CMC	230	500/1500
1—75	Whse.	8K-100L	125	650
2—75	El. Dy.	25-8L	230	750/1750
3—60/75	Whse.	8K-200	115	300/700
4—75	Cr. Wh.	53-H	230	950
2—75	G.E.	CDM-1126Y	230	2000
1—60	Whse.	8K-160	550	600
1—60	El. Dy.	25-8	230	525/1050
1—60	Whse.	8K	230	500/1000
1—60	Whse.	8K-131	230	500/1500
1—60	El. Dy.	258	230	750/1500
2—50	G.E.	RCP-31B	230	1700
4—50	Whse.	Hoist	230	400
1—50	Whse.	8K-153	230	600/1035
1—50	Cr. Wh.	CMC-80H	230	380/750
1—40	Whse.	8K-103	230	1800/2400
2—35	G.E.	RF-14	230	270/1000
2—30	G.E.	CD-115	230	500/1500
7—25/30	G.E.	CD-105	230	690/2070
3—25	Whse	8K-93	230	1310/1750
2—20	Whse	8K-90	230	1150
1—20	Whse.	8K-93	230	1750
2—20	GE	CD-103	230	400/1600

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	4000	G.E.	Auto. Extraction 250# ISP 15# Ext. 2400V 3 ph. 60 cy.
1	2000	G.E.	Condensing, 175# ISP—6600V. 3 ph. 60 cy.
1	1000	G.E.	Condensing 135/150# ISP 2300/4150V. 3 ph. 60 cy.
2	750	G.E.	Condensing 250/275# ISP 440V. 3 ph. 60 cy. (New 1944)
1	450	Whse.	Condensing 250/275# ISP 440V. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V D. C.
2	200	Cr. Wh.	Condensing 250# ISP Geared to 1200 RPM—125V D.C. Gen.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240V. 3 ph. 60 cy.
	100	G.E.	Non-condensing 150# ISP 2300V 3 ph. 60 cy.

A. C. MOTORS
3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	514
2—2000	Whse.		2300	120
1—1000	Whse.		2300	189½
2— 900	Al. Ch.	(New)	2200	150
1— 650	Whse.	NG	2200	138
1— 600	Whse.	Srvn.	440	360
1— 500	G.E.	ATI	480	900
1— 500	G.E.	TS	4150	600
1— 450	Whse.	Eng	2300	128.5
2— 350	G.E.	TS	2200	150
1— 320	G.E.	ATI	2300	690
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 300	Al. Ch.		440	600
1— 145	G.E.	ATI	550	720
2— 125	G.E.	ATI	440	450
1— 100	Whse.		550	600
2— 100	G.E.	TS-7651	440	450
1— 100	G.E.	TS	440	1800
1— 100	F.M.	Unused	440	600

SLIP RING

1—1000	Whse	CW	2300	700
2— 700	Whse.	CW	2300	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM-Mill	2200	450
3— 450	G.E.	IM	440	506
1— 400	G.E.	IM	440	720
3— 350	Whse.	CW	2200	900
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Al. Ch.	3 Brg	2300	505
1— 300	G.E.	IM	440	720
9— 300	Al. Ch	ASY	2200	708
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-5598	2200	1750
4— 100	G.E.	MT-546Y	440/2300	425
2— 100	G.E.	IM-16	2200	435
3— 100	G.E.	IM	440	600
3— 100	Al. Ch.	AK	2200	1200
1— 75	Whse.	CW-761	2300	1750
1— 60	Cr. Wh.	123-AQ	220	700
3— 50	Whse.	CI-638A	220	870
2— 50	Whse.	CIW-50	440	870

SQUIRREL CAGE

1— 250	G.E.	KT-559	440	800
1— 200	G.E.	IK	550	865
1— 200	G.E.	KT-557	440	1800
1— 125	Whse.	NIS	440	485
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	3585
2— 100	Al. Ch	AR	2200	1170
1— 100	G.E.	IK-Vert.	2300	450
1— 100	G.E.	KT-543	220/440	1740
1—200/112	GE	KF-559BS	440	1170/885

TRANSFORMERS
60 Cycles

Qu.	KVA.	Make	Type	Ph	Voltages
3	1250	G.E.	H	1	6600 x 550
1	1050	G.E.	WCTH	3	11000 x 445
1	1000	Maloney	OISC	3	13200 x 480
1	600	Penn	OISC	3	13200 x 120/208
1	600	Al. Ch	OISC	3	4000/2300 x 216
3	333	Phts	OISC	1	26400 x 2600
3	250	Al. Ch	OISC	1	2200 x 130
3	200	Whse.	OISC	1	7200 x 240/480
6	167	G.E.	OISC	1	2400 x 240/480
3	150	G.E.	OISC	1	2200 x 220/440
3	100	Al. Ch	OISC	1	2200 x 130
4	75	G.E.	H-KR	1	13200 x 110/220

SPECIAL OFFERING

1 Set 36 New Factory Armature Coils. For 1250 KW G.E. Generator Rigid Frame. Type ATB2—3600 RPM, 3 phase, 60 cycle, 480 volts.

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GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	900	6600	Westgh.
350	3550	2200	Westgh.-CS
300	1800	440	Al.-Ch.
300	900	440	GE-I-17
250	1200	440	GE-KTR
250	600	2300	Triumph
225	514	440	GE-I-14
200	490	2200	GE
200	600	440	Westg'h-CS
150	1200	440	GE Type I
150	600	2200	GE
125	3600	220/440	Al.-Ch. AN
125	1200	440	Century
125	340	220	A-C
100	1800	2300	Burke
100	1200	2200	Al.-Ch. AR
85	3600	2200	GE
75	1800	220/440	GE-K505S
75	1200	220/440	GE-K505Y
75	900	2300	GE
60	3600	2300	GE-KT
60	1800	220/440	A-C AR
60	1800	2300	GE-FTR
60	900	440	GE-KT346
50	3600	440	R. & M.
50	1800	220	Triumph
50	1200	2200	GE-KT343
50	900	220	GE
50	720	2300	Wtg.-CS
40	1800	220	A-C
40	1200	550	A-C AN
40	900	2300	Wtg.-CS
40	720	440	GE-KT
35	600	440	GE-Type I Form M
30	1800	440	A-C
30	1200	dual	Master
30	900	220	Al.-Ch.-AR fr. 220c
30	900	220	Wagner (Hi-Torque)
30	720	220	GE-HJ
30	514	440	Stanley
25	3600	dual	L-A
25	1800	dual	GE
25	1200	220	Weache
25	900	440	GE

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125•	1200	440	GE-TE-FC-BB
75	1200	2200	GE-TE-FC-BB
60	900	440	GE-TE-FC-BB
30	900	440	Reliance, TE-FC-BB
20	3600	dual	Delco-TE-FC-BB
20	1200	440	Wagner
20	900	440	GE-TE-FC-BB
15	1800	dual	Delco
15	1200	220/440	Delco-TEFC-BB
15	900	440	GE-TE-FC-BB
10	3600	220/440	F-M
10	1800	220/440	Delco
10	1200	440	GE-TE-FC-BB
7½•	1800	dual	Wagner-TEFC-BB
7½•	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-Hi Slip-TE-BB
7½	1200	dual	Delco
7½	1090	220/440	GE-Hi Slip
7½	900	dual	Delco-TEFC-BB
7½	3600	dual	Delco-TE-FC-BB
5•	1800	dual	Master-TEI C-BB
5	1800	220	Wagner TE-B BB
5	1200	dual	GE-TEFC-BB
5•	3600	dual	Delco, TE-FC-BB
3	1800	dual	Delco-TEFC-BB
3	1200	dual	Rel-TEFC-BB
3	900	dual	Delco
2	1800	dual	Delco-TEFC-BB

•New Motor

ENCLOSED SQUIRREL CAGE—Cont'd.

HP	RPM	Volts	Make
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
1½	900	dual	Delco-TEFC-BB
1½	1800	dual	L. Al-TE-BB
1½	1200	dual	Delco-TEFC-BB
1	3600	220	Haskins-TEFC
1	1800	dual	Master-TEFC-BB
1•	1800	dual	Delco-TE-BB
1	1200	220	GE-KT
¾	3600	4400	Delco-TE
¾	1800	dual	Weache-TE-BB
¾	900	dual	Delco-TEFC-BB
½	1800	440	Delco-TE-BB
½	1800	dual	Delco.-TE-BB

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
375	1800	2300	Al. Ch.
350	900	2300	Westgh.
300	720	2300	Al. Ch.
300	758	2200	Al. Ch.
250	720	440	GE-Type MT
250	900	2300	Al. Ch.
235	1800	220	GE-I
200	1800	440	Al.-Ch.
150	435	2200	GE Type I
125	1800	2200	Westgh. Type CW
75	1800	220	GE
75	900	440	Al.-Ch. ANV
75	720	2200	Wagner Type BB
75	360	550	GE Type I
75	360	220	GE Type I
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Weache
50	1800	220	GE-MT
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
40	1200	220	GF-MT-336
40	900	220	A-C
40	720	2300	Wtg.-HF
40	720	220	Al. Ch.-ARY
40	600	2300	Al. Ch -ARY
40	600	220	Al. Ch.-ARY
40	450	220	Triumph-C
35	900	220	Al. Ch.
35	900	2300	Ridgeway
35	720	220	GE
35	720	2400	GE
30	1800	2300	Wtg.-CW
30	1800	220	GE
30	1200	440	Wagner
30	600	220	F. Morse-BV

VERTICAL MOTORS

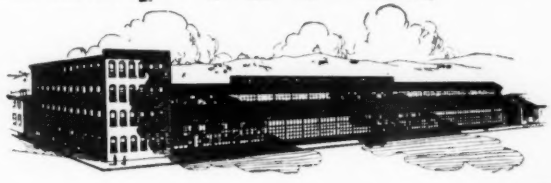
HP	RPM	Volts	Make
200	1200	440	Al. Ch.-SR
150	1200	2200	GE-I-SR
150	1200	440	GE-Cage
125	1200	2300	Al. Ch.-SR
125	1200	2300	Al.Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60•	1200	440	Al. Ch.-Cage

VERTICAL MOTORS—Cont'd.

HP	RPM	Volts	Make
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
40	1200	2200	Westgh.-BB-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25•	1550	230 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20•	1200	440	Al. Ch.-Cage
20	800	230 D.C.	GE-RC
15•	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al.-Ch.
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GE
6	850	110 D.C.	Rel
5	1400	115 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	3600	dual	Delco
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
3000	720	4800	GE-ATI
1015	500	2200	Wtg.-25 cycle
710	720	13200/6600	GE
500	514	440	GE
435	720	2300	GE TYPE ATI
320	900	2300	GE-ATI
250	1800	2300/4160	GE-ATI
250	225	2200	GE-T8
225	900	4100	GE-ATI
220	600	2300	GE-ATI
200	225	2300	Wtg., rotor & stator only
175	225	220	GE-TS (rotor & stator only)
160	600	440	GE-ATI
160	164	480	GE-TRF (rotor & stator only)
150	1800	2200	GE
150	1800	220	GE-ATI, Single Bearing
150	720	440	Westgh.
120	225	220	E-M, rotor & stator only
115	164	208	GE
100	1200	220	Wstg Single bearing
95	1200	220	Burke
75	1200	220	Westgh
75	900	2300	GE-ATI-7552
60	360	2200	GE, rotor & stator
50	1200	440	Wagner
50	900	220/440	Westgh.
50	720	440	GE-T8
50	360	440	GE, rotor & stator
50	300	220/440	Wtg. (rotor & stator only)
30	900	440	Wagner
30	600	550	GE rotor & stator
30	450	dual	Wtg., rotor & stator
30	360	550	GE
30	327	220	E-N, rotor & stator
25	1800	220	Wagner
25	450	220	E-M, rotor & stator
20	1200	440	Wagner
20	900	220	Wtg.
20	600	220	E-M, rotor & stator



D. C. MOTORS

115 Volts

HP	RPM	Description
225	750	GE-NYSC
75	750	GE-MPC
60	1200	Star
50	120	Al.-Ch.
35	975	Northern
30	1800	F-M
30	200/600	Sprague
25	1150	Triumph
20	700	Triumph
20	500/1500	GE-RF11
20	400/1200	GE-RLC fr. 202A
18	600	Sturtevant MPS
15	1200	J. & L.
15	1000	GE-CE
15	975	F-M
15	725	Westgh.-S fr 6
12	1075	J. & L.
12	530	Westgh.-SK-113
10	3450	Imperial
10	650	J. & L., type CI
10	400/1600	Watson-BW15B

GEAR HEAD MOTORS

60 Cycle A. C.

HP	Output RPM	Volts	Phase	Description
1/12	172.5	115	1	Westgh. Rt. Angle
1/6	19	220/440	3	Master PA-TEBB
1/4	269	440	3	Janette-Parallel shaft
1/4*	280	115/220	1	Master-Vertical-BB
1/4	19	220/440	3	B-Line-Rt. Angle
1/2	99	220/440	3	GE-Rt. Angle
1/2	190	220/440	3	Master-Parallel shaft
1/2	143	220	3	Master-Rt. Angle
1	190	115/230	1	Master-Parallel shaft
1	2.2 to 11	220/440	3	U. S. Varidrive
1-1/2	388	110/220	1	Master-Parallel
1-1/2	5.4	220	3	Jeanette Rt. Angle
2	96	440	3	Master-Rt. Angle
2	110	220/440	3	GE-Parallel
3	215/1500	3	3	Master-Vari-Drive
3	1000/5000	220/440	3	GE-Variable
5	200/1800	220/440	3	Delco-Variable Speed Transmission
5	6850	220/440	3	Master-Parallel
10	450	220/440	3	Master-Vertical
20/10	375/185	440	3	Master-Two speed motor

D. C. GENERATORS

125 Volts

KW	RPM	Description
500	750	GE-MCF
300	1500	GE-CCG
200	900	GE-MPC
200	800	GE-DMC
100	1000	WE-DLC
100	900	Wstg.-SK single bearing
55	1000	GE-Type TD
40	600	J. & L.-F Ped. Type
35	1165	GE-DLC
31.25	1400	Westgh.-SK-single bearing

D. C. GENERATORS

230 Volts

KW	RPM	Description
400	1200	Wstgh., single bearing
200	1200	GE-SYSC single bearing
175	450	Westgh.
125	1400	Westgh.-SK-130L
50	1200	Al. Ch.-E-127
35	1800	GE-RC
30	300	Triumph
22½	765	Westgh.-SK
20	1750	Delco Ballbearing
18	300	Burke
15	350	Westgh.-SK

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

ELECTRIC CO.

927 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

PROMPT SHIPMENT — PARTIAL LISTING

VARIABLE VOLTAGE DRIVES

40 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing for forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

SLIP RING MOTORS—3 Ph., 60 Cy.

On.	H.P.	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5201
1	7½	875	220	G.E.	MT-522
2	10	1140	440	West.	HF-7A
3	10	570	220	G.E.	HI-11
2	11‡	820	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-4464C
2	15	570	220	West.	CW-646
1	18	880	440	West.	MW-316
1	20	880	440	West.	CW-638
1	25	1150	550	G.E.	MT-323
3	25	850	220	Wagner	BR
3	25	720	440	Wagner	22VBR
1	30	885	440	West.	CW-646
1	30	850	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
3	40	865	2200	Al-Ch.	ARV-223C
1	40	500	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	860	440	West.	HF-12A
1	50	570	440	G.E.	MT-552
5	52‡	550	220	G.E.	IGC-5013***
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-938
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IT-16
2	150	1750	440	G.E.	MTP-549
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
3	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	600	1770	440	G.E.	IM-E15C
1	650**	360	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts.
‡Intermittent rating. ***2 phase.
**New. ‡‡25 Cycle.

230 VOLT CONST. SPEED D. C. MOTORS

On.	H.P.	Speed	Make	Type
20	2	850	West.	SK-20
7	3**	1150	Al-Ch.	EB-71
10	3	850	Reliance	Y-23T
20	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-66
3	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al.-Ch.	EB-80
2	10	850	West.	SK-83
10	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L851
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
1	60	1750/1310	West.	SK-143
1	180	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D.C. MOTORS

On.	H.P.	Speed	Make	Type
10	1½/2	500/2000	G.E.	CD-65
1	2	225/900	Reliance	78T
1	5	450/1800	G.E.	CD-83
2	6	450/1800	G.E.	RF-9
6	5/7½	500/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
2	10/15	600/2400	Reliance	T-92T
1	12½	280/840	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	400/1600	Reliance	T-230-T
1	20/25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1800	West.	SK-143
1	40/50	400/1200	Reliance	T-461T
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	230/500	West.	SK-220
2	375	350/600	G.E.	MPC

**New.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

On.	H.P.	RPM	Volts	Make	Type
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
2	5	1165	440	L.A.	JA-284
5	7.5	1740	440	G.E.	K-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXPF
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1760	220	G.E.	K-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	40	3565	440	G.E.	KF-4038

Splashproof, Ball Bearing

On.	H.P.	RPM	Volts	Make	Type
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
2	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335
1	200	885	440	L.A.	FS-1378

Open Type Motors

On.	H.P.	Speed	Volts	Make	Type
1	15	3485	220	Reliance	AA-H3247
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E	KT-312
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Hewell	SCRB-356***
2	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1160	440	West.	CS-644
1	30	870	220	West	CS-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West	CS-383C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-662C
1	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-3?2
1	100	690	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	125	435	440	Al.-Ch.	AR
2	125	400	2300	G.E.	I-17-FR
1	200	580	550‡‡	G.E.	K1-5668
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300/4000	West	CS-4-39D-12

220 volt motors can be reconnected for 440 volts.
**New ***2 Phase.
‡‡ Reconnectable for 440 volts

G. E. DYNAMOMETERS

Cradle Type, with Control and Dial Scale
(Write for Complete Specifications)

Qn.	HP	D.C. Volts	RPM	Type
1	50/75	250	1650/4000	TLC-26
2	100	250	1650/3600	TLC-50
1	200	250	1200	C

MOTOR GENERATOR SETS
125 and 250 Volts D. C.
(Write for complete Specifications)

KW	Make	RPM D.C.	Volts A.C.	Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/220†
10	West.	1750	125	220/440
10	West.	1450	125	220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1735	250	220/440
15	West.	1450	125	220/440†
16	West.	1750	125	2200/440
20	West.	1750	250	220/440
25	G.E.	1800	250	220/440
25	G.E.	1200	125	220/440
30	G.E.	1800	250	220/440
30	Al-Ch	1750	125	220/440
50	West.	1750	250	220/440
50	G.E.	720	125	220/440†
75	G.E.*	1200	125	220/440
75	G.E.	1200	250	2300/440
100	Columbia*	1200	250	2300/440
150	West.*	1200	250	2300/440

Note: 3KW, 5KW and 7.5 KW, 230 Volt Sets Also Available.
**New *Synchronous Motor Driven.
†50 Cycle ‡25 Cycle.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. CLEVELAND 14, OHIO

AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK

POWER PLANT EQUIPMENT

STEAM ENGINE GENERATOR SETS

2—575 KVA Skinner Unaflow—West. 240/480 V.
1—575 KVA Allis-Chalmers Corliss—220/440 V.
1—375 KVA Ames Vertical 220/440 V.
1—250 KVA Ridgeway four valve 2300 V.
1—187 KVA Ames Vertical 220/440 V.
1—156 KVA Ames Vertical 220/440 V.

STEAM TURBINE UNITS

Complete 2000 KW Turbo-Generator Plant:
1—1500 KW G.E. condensing—3600 RPM
1—500 KW G.E. condensing—3600 RPM
These units are of modern design, are 3 phase, 60 cycle, 2300 V.

DIESEL GENERATING UNITS

4 Diesel Generating Units, like new, comprising a complete diesel power plant, and consisting of two 450, one 300, and one 150 HP Fairbanks-Morse model 32-E engine-generator units. Engines are of all duplicate cylinder size, 2400/4160 V, 3 phase, 60 cycle. Late model Woodward governors, pumps, cooling tower, etc. Operated only a short time. Available for immediate delivery.

1—250 KVA—220/440 V. G.M. "twin"—NEW—not war surplus.

BEESON ENGINEERING CO.
1628 E. 7th St., Los Angeles 21, Cal.
MUtual 9151

FOR SALE
IMMEDIATE DELIVERIES
REASONABLE PRICES

AC DIESEL GENERATORS

Several 1000 KW, 2300V, Fairbanks Morse, O.P., 720 RPM w/New Elliott or Crocker Wheeler Generators.
Several 600 KW, 2300V, G.M.C., 12 cyl., 720 RPM, w/New Crocker Wheeler Generators.
Several 400 KW, 2300/480V, Baldwin, 6 cyl., 450 RPM, w/New ENCO Generators.
1—300 KW, 240/480V, G.M.C., 8 cyl., 1200 RPM.

DC DIESEL GENERATORS

1—610 KW, Cooper Bessemer, 8 cyl., 950 H.P. w/G.E. 500V, 750 RPM Generator.
10—300 KW, Baldwin/Westinghouse, 120/240V, 3 wire, 448 HP, 400 RPM, Like New.
2—300 KW, G.M.C., 8-268A, 120/240 volt, 3 wire, 1200 RPM.
Several 100 KW, GMC, 3-268A, w/Allis Chalmers, 120/240V, 3 wire Generators.
Several 100 KW, Superior, 8 cyl. w/Delco, 120/240V, 3 wire Generators.

Subject Prior Sale

SUNDFELT EQUIPMENT CO., INC.
220 Hudson Street, Seattle 8, Wash.
Lander 9311

FOR SALE

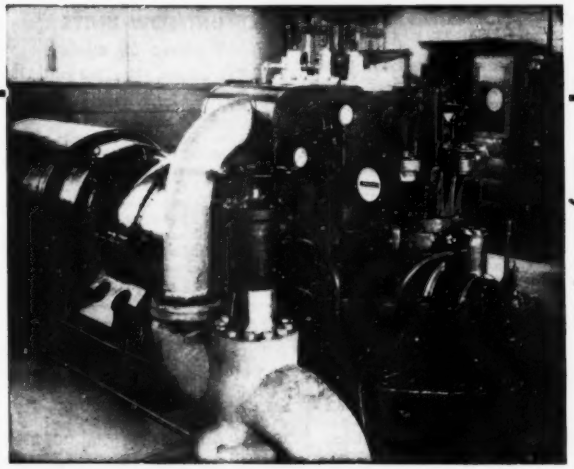
Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

50,000 lb. Integral Furnace 400 lb. B & W boiler superheater air heater pulverizer fans accessories
2500 KW 2400 volt GE Cond. turbine unit.
1500 KW 480 volt GE NonCond Turbine set.
283 KVA 240 volt Chase Uniflow engine set.
200 KVA 480 volt Ridgway 4 valve engine set.
200 KW G. E. M. G. Set 220/440 AC 250 DC.
50 KW G.E. M. G. Set 220/440 AC 250 DC.

HOWARD B. JOHNSON & ASSOCIATES
53 W. Jackson Blvd. Chicago 4, Ill.

Generate Your Own Power With "UTILITIES APPROVED" EQUIPMENT



Greater Values—Prompt Delivery

STRICTLY UTILITY, EFFICIENT WESTINGHOUSE CONDENSING STEAM TURBO-GENERATOR UNIT

AVAILABLE IMMEDIATE SHIPMENT

TURBINE

1500 KW, 250 P.S.I., 150° S.H. 28 inch vacuum direct connected to:

ALTERNATING CURRENT GENERATOR

1875 KVA, 1500 KW, 80% P.F. 3 phase, 60 cycle, 2400 volt 451 Amp. complete and equipped with:

ACCESSORIES

2700 square foot Westinghouse surface condenser, condensing auxiliaries, piping, valves, duplicate exciter sets, switchboard panels and instruments.

EXCELLENT CONDITION

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 5 stage, 2300/4000 volts, 200# pressure, 600°TT, 3600 RPM.

5000 KVA G.E., non-cond. Automatic Extraction, 13,800 volts, 600# P.S.I., 750 TT 150# extraction and 25# gauge back.

3125 KVA G.E. condens. 130 P.S.I. 550 volts. 3600 RPM.

3125 KVA G.E. condensing 175/200 P.S.I. 2300 volt, 500°TT, 3600 RPM complete.

1875 KVA G.E. non-condensing 150# pressure, 30# gauge back, good for maximum 260°o, 650°TT, 480 volts, 3600 RPM.

1563 KVA G.E. non-condensing 250 P.S.I. 25# gauge back, 2400 volts, 3600 RPM.

1563 KVA G.E. condensing 250 P.S.I. 2300 volts, 3600 RPM complete.

1560 KVA Allis condens. bleeder, maximum extraction 25,000# per hour, 240 volts.

925 KVA G.E. non-condensing 150 P.S.I. 15# gauge back, 480 volts, 3600 RPM.

625 KVA Westinghouse condensing 150/200# pressure, 2300 volt, 3600 RPM complete.

625 KVA G.E. non-condensing 150# pressure, 15# back, 2300 volts, 3600 RPM complete.

375 KVA (4) G.E. condensing 400# pressure, 2300/4150 volts each complete.

112 KVA Allis non-condensing 150 P.S.I. 10# gauge back, 240 volts, 3600 RPM.

100 KVA Westg. non-condensing 125 to 150 lbs. pressure, 10# gauge back, 2400 volts.

TURBINE-GENERATOR UNITS

Direct Current

400 KW (2) 240 volts direct current Crocker-Wheeler Worthington 440 lbs. condens.

150 KW (2) 3 wire, 250 volts, 225/250 psi, Westinghouse-Worthington condensing.

75 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM, 150 lbs. pressure non-condensing.

60 KW (3) new Westinghouse 120 volt, 200# pressure, condensing.

SYNCHRONOUS MOTORS

3 phase, 60 cycle

1500 KVA Westg. 2300 volts, 900 RPM synchronous condenser complete.

300 HP 80°o P.F. G.E., 2300 volts, 720 RPM.

900 HP Allis, 2200 volts, 150 RPM.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.

500 KW General Electric 600 volt DC, direct connected to 710 HP, 3 phase, 60 cycle, 2300 volt, 720 RPM synchronous motor.

400 KW General Electric 275 volt DC, direct connected to 710 HP, 3 phase, 60 cycle, 2300 volts, 720 RPM synchronous motor.

300 KW Allis-Chalmers, 250 volt DC generator direct connected to a 430 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1200 RPM synchronous motor.

621½ KVA G.E., 3 phase, 60 cycle, 2300 volt, 1200 RPM alternator direct connected 75 HP, 125 volt DC motor.

ROTARY CONVERTERS

500 KW (2) 6 phase, 60 cycle, 600 volts direct current, 1200 RPM West. sy. converters.

STEAM ENGINE-GENERATOR UNITS

Direct Current

400 KW G.E. 240 volts, 360 RPM generator connected to Skinner Unaflow vertical non-condensing engine, 150 lbs. pressure, 10 lbs. gauge back.

275 KW Westinghouse 250 volt, generator connected Ames vertical Unaflow engine.

250 KW (2) G.E. 250 volts generators connected Skinner Unaflow Engines.

200 KW, G.E. 125 volt, 200 RPM generator connected Skinner Unaflow engine.

30 KW (2) G.E. 125 volts, 425 RPM generators each direct connected G.E. vertical engine 125 P.S.I.

STEAM ENGINE-GENERATOR UNITS

Alternating Current—3 Phase, 60 Cycle

750 KVA G.E. 2300/480 volt, 150 RPM generator, connected Skinner Horizontal Unaflow non-condensing engine.

625 KVA Westge. 240 volts generator connected Skinner Unaflow Engine.

500 KVA G.E. 2300 volts generator connected Skinner Unaflow Engine.

500 KVA G.E. 240 volt, 360 RPM generator connected Skinner Vert. Unaflow engine.

375 KVA G.E. 2300/440 volts, 200 RPM generator connected 23"x24" Skinner Horizontal Unaflow non-condens. Engine 120-140 P.S.I.

250 KVA G.E. 240 volts, 225 RPM connected Chuse non-releasing engine 150 P.S.I.

DIESEL ENGINES

900 HP (10) General Motors, Model 12-567 ATL, 12 cylinders, 744 RPM Diesels.

1200 HP (4) Fairbanks-Morse, 8 cylinders, opposed piston, 720 RPM Diesel engines.

Special

1—New 8400 sq. ft., 2-pass Ingersoll-Rand Marine-type horizontal surface condenser.

UTILITIES MACHINERY CORP.

1965 EAST SIXTH STREET — **LONG DISTANCE 422** — **CLEVELAND 14, OHIO**

POWER PLANT MACHINERY

CONDENSING TURBO UNITS

3 phase 60 cycle

25000 KVA G.E., 13800 volts, 400# steam.
12500 KVA G.E., 2400 volts 200# steam.
6000 KVA (2) G.E., 4000 volts, 600# steam.
2250 KVA G.E., 2300 volts, 400# steam.
1875 KVA Allis, 480 volts, 400# steam, 150# extraction.
1563 KVA G.E., 2300 volts, 225# steam.
1560 KVA Allis, 240 volts, 180# steam, 5# extraction.
1250 KVA G.E., 4000 volts, 400# steam.
1250 KVA G.E., 2300 volts, 200# steam, 5# extraction.
937 KVA G.E., 480 volts, 200# steam, 25# extraction.
750 KVA G.E., 480 volts, 200# steam, 15# extraction.

NONCONDENSING TURBO UNITS

3 phase 60 cycle

5000 KVA G.E., 13800/6900/4000 volts, 600# steam, 150# extraction, 50# exhaust.
1563 KVA G.E., 2400 volts, 250# steam, 20# exhaust.
1250 KVA DeLaval, 4150/2300 volts, 400# steam, 125# extraction, 60# exhaust.
937 KVA G.E., 480 volts, 200# steam, 20# exhaust.
625 KVA G.E., 240 volts, 175# steam, 5# exhaust.
250 KVA (2) G.E., 480 volts, 150# steam, 15# exhaust.
156 KVA Murray, 600 volts, 225# steam, 35# extraction, 10# exhaust.

BOILERS

50,000# per hour B & W, 400# steam, coal pulverizer.
40,000# per hour Vogt, 450# steam, chain grate stoker.
40,000# per hour B & W, 200# steam, chain grate stoker.
18,000# per hour Erie City, 200# steam, spreader stoker.

UNIFLOW UNITS

3 phase 60 cycle

1125 KVA Skinner, 4160/2400 volts, 175# steam, surface condenser.
750 KVA Skinner, 2300 volts, 160# steam, 5# exhaust.
625 KVA Skinner, 240 volts, 150# steam, 5# exhaust.
625 KVA Ames Vertical, 2300/480/240 volts, 150# steam, 5# exhaust.
500 KVA Skinner, 450 volts, 130-160# steam, 5# exhaust.
312 KVA Skinner, 480 volts, 115-140# steam, 5# exhaust.
200 KVA Skinner, 240 volts, 125-140# steam, 3# exhaust.

MOTOR GENERATOR SETS

3 phase 60 cycle

750 KW Allis, 250 volts DC, 2200 volts AC, synchronous.
500 KW G.E., 275/550 volts DC, 2300 volts AC, synchronous.
200 KW G.E., 125/250 volts DC, 2300 volts AC, synchronous.
60 KW G.E., 125 volts DC, 440 volts AC, induction.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

Modern Equipment

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE	YEAR
1800	General Motors	18-2SBS	900	4	1943
1600	Fairbanks Morse	38D8⅛OP	720	2	1944
1600	Hamilton	RB99-D.A.	700	2	1944
1600	General Motors	16-278A	720	2	1944
1200	General Motors	12-278A	750	2	1944
1200	General Motors	16-184A	1800	2	1943
900	General Motors	12-567ATL	750	2	1942, 44
800	General Motors	6051 Quads	650	2	1943
500	Superior	6-cyl.	514	4	1942
300	Fairbanks Morse	38-O P	1200	2	1936
225	General Motors	6-71	2100	2	1943
150	Superior	GDB-8	1200	4	1942/44
90	Hercules	DWXDS	1800	4	1943

DIESEL GENERATOR SETS

AC	200 KW	3/60/450	1200 RPM	General Motors	8-268A	1943 } Rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	1943 } 1948
DC	1200 KW	525V	750 RPM	General Motors	16-278A	1943
	650 KW	240V	750 RPM	General Motors	12-567	1943
	250 KW	120/240	1200 RPM	General Motors	8-268A	1944
	125 KW	120/240	600 RPM	Superior	VDMB	1944
	100 KW	120/240	1200 RPM	Superior	GDB-8	1942/44
	100 KW	120/240	1200 RPM	General Motors	3-268A	1943/44
	60 KW	120V	1200 RPM	Buda	909	1942
	10 KW	120V	1200 RPM	Hercules	DOOD	1943

MOTORS—D.C.

1500 HP 525 V DC 600 RPM Whse.
667 HP 374 V DC 1360 RPM Elliott.
444 HP 250 V DC 900 RPM Elliott.
222 HP 230 V DC 3050 RPM Whse.
15 HP 120 V DC 500 RPM Diehl

Ask for our new 1949
CATALOG
just off the press

TURBO-GENERATORS—A.C.

1—1000 KW All. Chalmers 3/60/600, 3600 RPM. cond., 140# steam press.
2—250 KW G.E. type AT1 3/60/450, 1200 RPM. cond.
2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).
6—200 KW G.E. type ATB 3/60/450, 1200 RPM cond. and non cond.
2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

TURBO-GENERATORS—D.C.

KW	Volts	Winding	Speed	Type
2—375	180/240	Shunt.	1200	non-cond.
5—300	120	Compd.	1200	cond.
1—300	240	Compd.	1200	cond.
4—150	120	Shunt.	1200	cond.
8— 60	120	Stab. Sh.	1800	cond.
3— 25	120	Stab. Sh.	1800	cond.

CONDENSERS

Most are new

No.	Sq. Ft.	Make	Passes	Tubes
4	3300	Str. Wells	2 Alu Brass	¾"
1	2200	Alco	2 Cu Ni	⅝"
4	1050	Conseco	2 Cu Ni	⅝"
1	700	Bethlehem	2 Brass	⅝"
15	400	All.Chalm.	2 Brass	⅝"
8	155	Conseco	2 Brass	¾"
17	349	Luboil Coolers	CU Ni	⅝"

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31 Nassau Street New York 5, N. Y.
Tel. REctor 2-1334

ARRANGE FOR INSPECTION

"BREW, WOLTMAN OFFERS"

TURBINE UNITS

1—12500 KVA Al. Ch. Cond. 60 cy. 6900 V. 250-lb. 600 deg FTT. Surface condenser.
1—12500 KVA Al. Ch. Cond. 60 cy. 13200 V. 240-lb.
1— 9375 KVA Cond. 50 cy. 13800 V. 600-lb. 825 deg. FTT with surface condenser & boiler. NEW.
1— 5000 KVA G. E. Non-C. 60 cy. 13200 V. 600-lb.
2— 5000 KVA West Cond. 60 cy. 13200 V. 240-lb.
2— 4500 KVA West. Cond. 60 cy. 6600 V. 200-lb.
1— 3125 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lbs., 40-lb. BP.
1— 1563 KVA G. E. Ext. 60 cy. 2300 V. 400-lb. IP. 160-lbs. Ext. Cond.
1— 1250 KVA DeLaval Non-C. 60 cy. 2300 V. 250-lbs.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lbs.
1— 940 KVA Elliott Cond. 60 cy. 480 V. 400-lbs.
1— 125 KVA West. Non-C. 60 cy. 240 480 V. 150-lbs., 5-lbs. B.P.
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor

BOILERS

2—508 HP Casey Hedges Bent tube.
1—507 HP Comb. Engr. 400-lb. 620 deg. TT. Oil.
2—253 HP B & W. 225-lb. Bent tube.
2—200 HP Erie Economic 125-lb. Stokers.
1—180 HP Frost 200-lb. Return tubular.

DIESEL ENGINE UNITS

2—1600 HP Fair. Morse 60 cy. 2300 V. NEW gen.
2— 900 HP M.A.N. 2300 V. 60 cy. NEW
1— 720 HP Amer. Loco 240 V. DC.
1— 625 HP Worth. 240 V. 60 cy. gen.
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 400 HP DeLaVergne 2400 V. 60 cy.
1— 375 HP Worth. 240 V. 60 cy. gen.
2— 240 HP Fair. Morse 2400 V. 60 cy.
1— 150 HP Gen. Motors 3-378A-60-3-480.
2— 125 HP Murphy 240 V. 60 cy.

SYNCHRONOUS MOTORS—60 Cy.

2—3000 HP G. E. 2300 V. 257 RPM
1—1400 HP G. E. 4150 V. 514 RPM
1— 880 HP G. E. 6600 V. 514 RPM
1— 600 HP G. E. 440 V. 360 RPM
2— 500 HP E. M. 2200 V. 514 RPM
3— 400 HP E. M. 440 V. 660 RPM

NEW MOTORS STOCK 20 — 200 HP

1— 350 HP G. E. 440 V. 900 RPM
1— 300 HP G. E. 2300 V. 600 RPM
1— 300 HP West. 2300 V. 900 RPM
1— 250 HP West. 600 V. 180 RPM
1— 250 HP G. E. 550 V. 400 RPM
1— 200 HP G. E. 220 V. 600 RPM

INDUCTION MOTORS—60 Cy.

1—8000 HP Cr. Wh. S. R 2200 V. 895 RPM
1—7200 HP S. R 11000 V. 750 RPM 25 cy.
1—1000 HP G. E. S. R 2200 V. 514 RPM
2— 450 HP West. S. C 4150 V. 360 RPM
1— 300 HP West. S. R 2200 V. 1770 RPM
1— 250 HP G. E. S. R 2200 V. 1800 RPM
1— 200 HP Cr. Wh. S. C 2300 V. 900 RPM
1— 200 HP Cr. Wh. S. C 2300 V. 720 RPM. NEW.
1— 200 HP G. E. S. R 2200 V. 435 RPM
1— 150 HP Cr. Wh. S. C 440 V. 1800 RPM. NEW.
1— 150 HP Cr. Wh. S. C 440 V. 1200 RPM. NEW
1— 150 HP Cr. Wh. S. C 440 V. 900 RPM. NEW.

MOTOR GENERATOR SETS

2—1500 KW West. 250 V. DC 60 cy.
2—1000 KW G. E. 600 V. DC 60 cy.
1— 500 KW G. E. 250 V. DC 60 cy.
1— 200 KW G. E. 60 V. DC 60 cy.
4— 91 KW G. E. 60 V. DC 60 cy.
1— 75 KW Star 240 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 18 KW West. 60 V. DC 60 cy.

ROTARIES—60 Cy.

1—2929 3705 KW Gen. Elec. 225 285 V.
1—2025 2565 KW Gen. Elec. 225/285 V.
2—2000 KW Gen. Elec. 600 V.
2—1500 KW Westinghouse 270 V.
1—1000 KW Westinghouse 600 V.
1— 500 KW Westinghouse 250 V.

MERCURY ARC RECTIFIERS

2—4500 KW Multi Anode 600 V. DC
2—3250 KW Ignitron 650 V. DC
1—1850 KW Ignitron 275 V. DC

FREQUENCY CHANGERS

1—12500 KVA G. E. 25/60 cy. 300 RPM
1— 1250 KVA West. 25/60 cy. 300 RPM
1— 2500 KVA G. E. 25/60 cy. 300 RPM
2— 1000 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

TRANSFORMERS—60 Cy.

1—2000 KVA G. E.	69000—13800/23900 Y 3 ph.	
3— 500 KVA G. E.	66000—13200/6600	
3—1000 KVA West.	66000—11000	
4—1000 KVA G. E.	66000—2400/4150 Y	
1—5000 KVA G. E.	33000—2300/4000 Y 3 ph.	
1—3000 KVA West.	33000—2300/3990 Y 3 ph.	
6— 50 KVA G. E.	33000—2300	
6— 75 KVA Moloney	33000—2300/6900	
3—3750 KVA West.	26400/13200—2400	
4— 450 KVA Al. Ch.	25410/44000—13280 2300 Y	
1—2500 KVA Al. Ch.	13200—2300, 3 ph.	
1—2500 KVA Packard	13200—2300, 3 ph.	
3—1000 KVA Pittsburgh	13200—2300	
1— 750 KVA G. E.	13200—480, 3 ph. Unit Substation	
2— 200 KVA G. E.	11500—220/110	
3— 200 KVA Moloney	11000—2300	
3— 167 KVA G. E.	7200/12400 Y—240/480	
1—1500 KVA West. Auto	4000—2300, 3 ph.	
3— 250 KVA Al. Ch.	2300—460	
3— 500 KVA Pittsburgh	2300—230/460	
3— 20 KVA West.	2200—575/287½	
12— 15 KVA Standard	450 225—117 234	
2—27½ KVA G. E.	440—220/110	

OIL CIRCUIT BREAKERS

1— 400 A. 73 KV G. E. FHKO-236		Outdoor
1— 400 A. 73 KV G. E. FHKO-136		Outdoor
1— 600 A. 73 KV G. E. FHKO-139		Outdoor
3— 400 A. 37 KV West G-11		Outdoor
1—1200 A. 25 KV G. E. FHKO-256		Outdoor
1—1000 A. 23 KV Kelman CB-76		Outdoor
4— 600 A. 15 KV G. E. FHKO-138BS		Outdoor

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BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

MOTOR GENERATORS

1—500 KW G.E. Syn. 600 V. DC. 900 RPM 440/2300/4000 V. AC, 3 P., 60 C.

1—400 KW West. Syn. 600 V. DC. 720 RPM. 2300/4000 V. AC, 3 P., 60 C.

2—300 KW G.E. Syn. 250 V. DC, 1200 RPM 440/2300/4600 V. AC, 3 P., 60 C.

2—200 KW G.E. Syn. 250 V. DC, 1200 RPM 2300/4000 V. AC, 3 P., 60 C.

1—150 KW G.E. Syn. 250 V. DC, 1200 RPM 2300/4000 V. AC, 3 P., 60 C.

SYNCH. CONVERTERS

1—500 KW West. 250 V. 6 P., 60 C. 1200 RPM, 2300/4000/6900/13,200 V. Trans.

1—300 KW G.E. 250 V. 6 P., 60 C. 1200 RPM, 440/2300/4000/13,200 V. Trans.

1—300 KW G.E. 600 V. 6 P., 60 C. 1200 RPM, 2300/4000/6900/13,200 V. Trans.

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502 Grant Building, Pittsburgh, Pa.

asme—BOILERS—nat'l. b'd.

4—404 HP sectional header oil burners
1—400 HP Erie City, low head (3) drum, oil.
2—500 HP complete plant, 1942.
2—600 HP Stirling type low head spreader stokers complete plant 1942
3—84" suspended HRT single settings
Capacities based on 100% rating

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POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

2—New 4000 KW Cond. 2400/4160 V. 750° T.T.
1—3500 KW 2300 V Cond.
1—2500 KW 600 V Cond.
1—2500 KW 2300 V Cond.
1—2000 KW 600 V Cond.
1—1500 KW 480 V. Extract 400#
1—1500 KW 2300 V Cond.
2—1250 KW 2300 V Cond.
1—1000 KW 2300 V Non-C.
2—1000 KW 440 V Cond.
1—1000 KW 480 V. Extract 300#
1— 750 KW 480 V. Extract 145#
1— 750 KW 600 V Extr.
1— 600 KW 240 V Cond.
1— 400 KW 480 V Non-C.
1— 250 KW 2300 V Non-C.

TURBO-GENERATORS (Continued)

1— 250 KW 240 V Non-C.
1— 150 KW 2300 V Non-C.
1— 125 KW 600 V Extrac.
1— 100 KW 600 V Non-C.
1— 50 KW 220 V Non-C.

TURBINE—Only

1—New 465 HP—3550 RPM 900 PSI.

WATER-WHEEL GENERATORS

2—250 KW Vert. 21' Hd. 3 ph. 60 cy—550 volts

ENGINE GENERATORS

1—900 KW NEW Skinner Uniflow 2400/4160 volts
1—500 KW 2300 V Unit.
1—400 KW 125 V Unit.
1—375 KW 2300 V Unit.
1—168 KW 220 V Unit.
1—168 KW 550 V

BOILERS

2—40,000# 200#
2—30,000# 425#
1— 623 HP 450#
1— 487 HP 200#
1— 300 HP 200#
1— 220 HP 160#
1— 200 HP 175#
6— 200 HP Sterling 180#
2— 190 HP 160# NEW

AIR COMPRESSORS

1—6000 CFM 50# Motor
2—2000 CFM 100# Motor
1—1700 CFM 100# Motor
2—1299 CFM 100# Motor
1—6000 CFM 5.1# NEW
1—5000 CFM 10# Rotary Type Motor

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The Buyers Must Be Satisfied—Always

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 PHASE—25 CYCLE—220/440 VOLTS

H.P.	Make	Type	Frame	RPM
50	Fairbanks Morse	H15B	Ball Bearing	750
75	Fairbanks Morse	H18C	B.B. Slipring	750
75	Gen. Elect.	IK	2200 volt	750
75	Gen. Elect.	IK		1500
100	Allis Chalmers			1450
150	Gen. Elect.	IK-17		365
150	Gen. Elect.	IK-16		480
150	Gen. Elect.	IM-16	Slip Ring	480
180	Allis Chalmers			1450
150	Gen. Elect.	KT	557	1455
400	Gen. Elect.	IM 17A	Slip Ring	720
500	Gen. Elect.	IK		485
600	Gen. Elect.	MT	Slip Ring	490
600	Westinghouse	CS		490

INDUCTION HEATING SET

GENERATOR—175 KVA General Electric A.C. Generator, type A.S.C. form AL, single phase, 800 volts, 3000 cycle, 1800 RPM, serial #5513639.

GENERATOR EXCITER—1 KW, General Electric Generator, type EE, form EB, 125 volts, D.C., 1800 RPM, 8 amps., serial #1758709.

MOTOR—300 HP General Electric synchronous motor, type TS, form EL, 3 P.F. 3 phase, 60 cycle, 440 volts, 1800 RPM, serial #5513638.

MOTOR EXCITER—3 KW, General Electric Generator, type EF, form EB, 125 volts, DC, 1800 RPM, 24 amps. serial #1758730.

Motor and Generator are direct connected, 4 bearing. Mounted on factory fabricated base, with direct connected exciters.

3000 Cycle Control is mounted in cubicle also containing 300 HP General Electric synchronous motor starting control.

3 PHASE 550 VOLTS 25 CYCLE MOTORS
Write for our stock list of approximately 500—3/25/550 Voltmotors

700 KW M.G. SET

2—350 KW Gen. Elect. Type MPC 250 volt, 720 RPM Generators will direct connect to 1000 HP Synchronous Motor or will sell Generators separately.

SLIPRING MOTORS
3 Phase—60 Cycle—220/440 Volts

H.P.	Make	Type-Frame	Speed	Remarks
2— 20	LA1	KH	900	
20	G.E.	MT-303	1800	
30	Cr. Wh.		1800	
3— 35	West.	CW	585	
35	G.E.	MT-343	690	
35	West.	MW	680	
40	West.	CW-748A	690	
6— 40	G.E.	MT-336	1200	
40	G.E.	MT-523	1800	
50	G.E.	MT-536	1200	
50	G.E.	MT-527	1800	
2— 50	West.	CW	1800	
60	G.E.	MT-533	1800	
60	West.	CW-653C	1800	
100	West.	CW	435	3 bearing
2—100	G.E.	I form M	900	
2—100	G.E.	MT-347	1800	
125	G.E.	I form M	1200	
2—250	G.E.	I form M-16	900	
350	West.	CW	435	2200 volts
500	Al. Ch.	ANY-WB	514	2200 volts
600	G.E.	MT	490	25 cycle
This motor will rewind satisfactorily to				
700	G.E.	MT	720	

HORIZONTAL & DUPLEX
Compressor & Vacuum
Pumps after Coolers, Filters

FREQUENCY CHANGERS
All Sizes in Stock, 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle.

NEW TRANSFORMERS

3—25 KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps
3—37½ KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps
6—50 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—75 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps.
3—150 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—200 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—250 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—333 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.

TRANSFORMERS

3—100 KVA Gen. Elec. Transformers, Type H Form KF—2400/4160 volts primary 120/240 volts secondary. Price $450.00 each. Electrically O.K. F.O.B. truck, Minnesota.

3—200 KVA Westinghouse Transformers, 1 Phase 25 cycle 2300 volts Primary 230 volts Secondary—Guaranteed.

SPECIAL OFFERING

200 KW Westinghouse NEMA Frame Generator 250 Volt DC, 1200 RPM, direct connected to
300 HP Westinghouse Synchronous motor 3/60/208/1200 RPM, A.C.—D.C. Panels—Like New
Immediate Shipment.

Write for complete listings of 60 cycle—25 cycle—DC motors and controls.

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HERE'S THE BEST IN GOOD USED BOILERS... PRICED RIGHT!

FIREBOX

10 HP Farrar & Treffts 100# Gas
52 HP Kewanee 160#
71 HP Farrar & Treffts 125# oil
73 HP Oil City 100# Grates
80 HP Erie City 125#
85 HP Kewanee 100# Retubed
90 HP Keeler 125#
100 HP Ames 150# Grates
102 HP Ames 125# Grates
125 HP Erie City 150#
125 HP Titusville 125#
135 HP Erie City 150#
143 HP Erie City 125# Grates
150 HP Kewanee 125# Stoker
200 HP Erie City 125# Stoker
250 HP Fitzgibbons 150#

SCOTCH

25 HP Orr & Semmbower 150# Oil
30 HP Leffel 100# Oil
50 HP Keeler 150#
75 HP Leffel 125#
125 HP Freeman 125# Grates
150 HP Springfield 125# Grates
150 HP Leffel 150# Oil
150 HP Walsh Weidner 156#
170 HP Brady 100# Stoker
200 HP Marine 155# 3 furnace
200 HP International 100#
200 HP International 125# Grates
200 HP Continental 125# Stokers
250 HP Geary 130# Oil
250 HP Leffel 185#
250 HP Springfield 150# Grates

BENT TUBE WATERTUBE

110 HP Erie City 180# Oil
150 HP Bros 150#
155 HP B&W 270# Oil
162 HP B&W 200# Stoker
190 HP Vogt 160# Stoker NEW
220 HP Vogt 160# Oil
200 HP Erie City 160# Oil
200 HP B&W Integral 200# Oil
250 HP B&W Type H 160# Stoker
253 HP B&W Type H 225# Stoker
300 HP Erie City VL 100# Stoker
310 HP Keeler CP 160# Stoker
316 HP B&W Integral 160# Stoker
329 HP Union Iron L 200# Stoker
400 HP B&W class P 250# Stoker
460 HP Lasker 250# Stoker
487 HP B&W 200# Stoker
505 HP Bros 200# Stoker
506 HP Casey Hedges 325# Stoker
605 HP Wickes 3 drum 200# Stoker—Gas
623 HP Vogt 450# Stoker
47000# /hr Combustion 450# NEW
140000# /hr Combustion 600# NEW

PACKAGE STEAM GENERATOR

15 HP Orr & Sembower 150# Oil
25 HP Steamaster 125# Gas
30 HP Cyclotherm 15# Oil
50 HP Cleaver Brooks 100# Oil
50 HP Cleaver Brooks 125# Oil
60 HP Cleaver Brooks 125# Oil
90 HP Cyclotherm 125# Oil
160 HP Bessler 300# 5800 F Oil
300 HP Cleaver Brooks 15# Oil

SECTIONAL HEADER WATERTUBE

180 HP B&W 200# Steel
250 HP B&W Marine 200# Oil NEW
300 HP B&W 200#
300 HP B&W 200# Stoker
400 HP Walsh Weidner 350# Stoker
400 HP Walsh Weidner 275# Stoker
404 HP Springfield 160# Stoker
485 HP B&W Marine 250# Oil
493 HP Springfield 225# Stoker
500 HP Walsh Weidner 175#
565 HP Springfield 160# Stoker
600 HP B&W 215#

BOX HEADER WATERTUBE

48 HP International 150# Oil
120 HP International 125#
150 HP Keeler 125#
170 HP Casey Hedges 170#
175 HP Keeler 200# Stoker
200 HP Heine 160#
250 HP Casey Hedges 150#
255 HP Heine 180# Grates
300 HP Oil City 160# retubed
308 HP Heine 200# Grates
350 HP Union Iron 200# Oil
350 HP O'Brien 150#
400 HP Erie City 200# Stoker
404 HP Edgemoore 100# Stoker
414 HP Murray 260# Stoker
426 HP Heine 180#
462 HP Heine 200# Stoker
500 HP Bros 200#
600 HP Heine 175#
607 HP Heine 200# Stoker
650 HP Casey Hedges 225#

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507 Fifth Avenue, New York City
MUrray Hill 7-6547-8-9

MOTORS AND CONTROLS
AT REDUCED PRICES!

NEW SLIP RING
220/440 VOLTS

Qu	HP	RPM	Mfg.	Shaft
1	100	720	Elliott	3½ x 6
2	125	720	Elliott	4 x 12
1	150	720	Elliott	4 x 12
2	500	1200	Elliott	4½ x 8

All sealed sleeve bearings, on original skids.
New control available for each motor.

Reconditioned and guaranteed
SLIP RING

HP	RPM	Volts	Mfg
500	450	2300	G.E.
450	514	440	Whse.
400	514	2300	Allis
350	450	2200	Whse.
300	600	2200	Whse.
250	600	440	G.E.
200	1200	440	G.E.
150	1200	2300	G.E.
100	600	440	G.E.
75	1800	220	G.E.
75	450	440	Allis
60	900	220	G.E.
50	1200	220	G.E.
30	1200	440	G.E.

M. G. SETS
600 KW MG SET
250 volts D.C. 440 volts A.C., G.E., with syn. motor. Complete with control. Nearly new.

KW	DC Volts	AC volts	Mfg.
1000	250	4160	G.E.
500	250	2300	G.E.
400	250	2300	G.E.
300	250	2300	G.E.
250	250	2300	C-W
200	250	2300	Whse.
200	250	440	G.E.
150	250	440	G.E.
100	250	440	Star
75	250	440	Star
50	250	220 440	Rel.
30	250	220 440	Rel.

Reconditioned and guaranteed
SYNCHRONOUS

HP	RPM	Volts	Mfg. Whse.	Type Engine
650	138	2300	G.E.	80%
600	450	2300	G.E.	80%
500	120	2300 4060	E-M	80%
500	600	2300 4160	G.E.	80%
500	514	440	E-M	100%
400	720	440	G.E.	80%
350	900	440	G.E.	100%
300	514	440	G.E.	100%
250	600	4160	E-M	100%
150	900	4160	G.E.	80%
75	900	220	E-M	80%

NEW DIRECT CURRENT
230 VOLTS

Qu.	HP	RPM	Mfg.	Frame
3	3	600 2660	G.E.	284
15	5	850 1700	G.E.	CD-66
5	7½	515 1750	G.E.	CD-77
4	7½	575 1750	Rel.	T-46
3	10	1750 2200	Rel.	T-34
5	30	850 1700	Rel.	T-230
2	75	400 1200	Rel.	T-651
2	75	1750	E-M	1509
1	250	1750 2300	CW	

All ball bearing—drip proof

Reconditioned and guaranteed
DIRECT CURRENT
230 volts Adjustable Speed

HP	RPM	Mfg
250	400/1200	E-D
200	300/900	Whse.
200	400/1200	Rel.
150	300/900	Whse.
150	400/1200	Whse.
125	400/1200	Rel.
50 100	600/2200	Rel.
100	500/1500	Whse.
100	300/900	Rel.
75	500/1500	C-W
60	500/1500	Whse.
60	400/1200	Whse.
50	300/1200	Whse.
40	500/1500	L-A
25	400/1200	G.E.

Buy from BOSWICK with confidence

WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 AKRON 9, OHIO

POWER EQUIPMENT

PUMPS
Rotary Pumps Turbine Dr. • Centrifugal Pumps Turbine Dr. • Centrifugal Pumps Motor Dr. (Vert. & Horizontal) • Reciprocating Pumps Duplex (Vert. & Horizontal) • Reciprocating Pumps Simplex (Vert. & Horizontal)

NORTHERN METAL CO.

IMMEDIATE DELIVERY

NUMEROUS OTHER ITEMS AVAILABLE FOR INDUSTRIAL USE

FOR COMPLETE INFORMATION — WRITE — PHONE

DIESEL ENGINES

General Motors 900 HP Model 12-567, 2 cy. 12 cyl. 744 RPM with Falk reversing and reduction gear, ratio 2½ to 1. Electric starting. Auxiliaries available.

DIESEL GENERATORS

100 KW DC 240/120 V., 417 Amps. 1200 RPM Motor: Superior, 150 HP Model GDB-8 8 cyl., Electric starting.

TURBO-GENERATORS

132 KW. AC, GENERAL ELECTRIC, Generator: 450 & 220 V, 3 Phase, 60 cycle, 1200 RPM. 275 Amps. Exciter: 40 KW. DC. 120 V. 22.6 Amps. Reduction Gear: 10071 to 1200 RPM. Turbine: 172 KW. Condensers available.

60 KW. DC. WESTINGHOUSE, Generator: 120 V. 1800 RPM. 500 Amps. Reduction Gear: 7283 to 1800 RPM. Turbine: 60 KW. 89.4 H.P. Condenser available.

MILNOR & BLEIGH STS. • *Phone MAyfair 4-1400* • PHILA. 35, PA.

NEW and REBUILT ELECTRIC POWER EQUIPMENT

SPECIAL
750 GPM Dayton-Dowd Fire Pump 75 HP 3 ph 60 cy 220 V 1750 rpm GE motor.

SQUIRREL CAGE MOTORS 60 CY 3 PH

HP	Make	Type	Speed
275	GE	KF 559	1800
150	West	CS	1800
100	GE	I-K	575
100	GE	KTP	1800
75	GE	I-K	600
75	West	CS	720
75	GE	I-K	720
75	A.C.	AR	1800
75	GE	KT	1800
60	West	CS	900
60	Wagner	BR	1200
50	A.C.	AR	600
50	GE	KT	720
50	GE	KT	900
50	West	CS	1200
50	GE	KT	1800
50	A.C.	ARWWX	3600
40	GE	KT	720

SLIPRING MOTORS 60 CY 3 PH

HP	Make	Type	Speed
450	West	CW	500
150	P.M.	HV	1800
100	GE	I-M	1800
60	GE	MT	900

GEARED MOTORS 60 CY 3 PH

HP	Make	Type	Speed
60	West	CS	290
60	GE	KF	427
50	GE	M	233
40	GE	KF	561
30	GE	KF	555
20	West	CS	778
15	GE	KG	563
15	West	CS	875
10	West	CS	440
7½	West	FD	61
7½	Master	PA	318
7½	West	CW	61
5	Reliance	AA	44
5	GE	KG	147
3	Reliance	SB	68/34

HOIST DUTY MOTORS 60 CY 3 PH

HP	Make	Type	Speed
300	GE	MTC	600
60	GE	MTC	600
50	Imperial	W-55	850
40	GE	MTC	1200
10	West	CI	600
10	GE	MTC	1200
7½	West	CI	870

SYNCHRONOUS MOTORS 60 CY 3 PH

HP	Make	Type	Speed
300	GE	TS	720
150	GE	TS	720
145	West		1200
108	GE	TS	1200
35	GE	TS	1800

230 VOLT DC MOTORS

HP	Make	Type	Speed
150	Cr. Wh.	83H	900
125	A.C.		600
100	GE	CDM	1200
100	Elec Dyn	10SM	1800
50	West	SK	600
50	Burke	WA6S	1450

SPECIAL
TRANSFORMERS 1KVA to 200 KVA. Write for complete list, recently purchased, available at ridiculously low prices.

AC GENERATORS

KVA	Make	Type	Speed
300	GE	ATI	900
200	West		600
219	GE	ATI	257
160	GE		1200
75	Elec. Machy.		900

AC-DC MOTOR GENERATOR SETS

KW	Make	AC	DC
400	Ideal	2300	250/125
100	G.E.	2300	250
75	Cr. Wh.	440	125
60	G.E.	440	125
60	G.E.	220	125

SPECIAL
OUR NEW FREE CATALOG NO. 49. Listing thousands of items is now available. WRITE!

SPECIAL
50 Cy 1450 rpm
NEW WESTINGHOUSE MOTORS
Ball Bearing Dripproof, export packed
5—1½ HP—190/380 volts
5—2 HP—190/380 volts
50—3 HP—190/380 volts
25—5 HP—380 volts only

SPECIAL
GASOLINE AND DIESEL ENGINE GENERATOR SETS
from 1 KW to 100 KW AC and DC

EMPIRE ELECTRIC COMPANY INC.

91 JAY STREET **PHONE MAIN 4-6868** **BROOKLYN 1, NEW YORK**

MOTORS and ELECTRICAL EQUIPMENT

SQUIRREL CAGE MOTORS 3-PHASE, 60-CYCLE

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	400	G.E.	KT-412	2300	450
1	400	G.E.	KT-412	550	450
1	300	Al. Ch.	AR	440	500
1	250	Whse.	CS	2200	1160
1	250	Whse.	CS	440	1160
1	200	Al. Ch.	AR	220/440	580
1	150	Fl. Mchy.	IC	220	1200
1	150	Whse.	CS-772	2200	1170
1	150	G.E.	I-K	440	720
1	150	Cr. Wh.		440	600
1	125	Whse.	CS-761	440	1750
1	125	Whse.	CS-772	2200	1170
1	125	Whse.	CS-772	440	1170
2	125	Al. Ch.	AR	440	435
3	100	Whse.	CS-663	440	1750
1	100	Al. Ch.	AR-226	2200	1160
1	100	Al. Ch.	AR-226	440	1160
5	100	F.M.	HS-201C	440	880
1	100	G.E.	KT-556	2200	865
2	100	G.E.	KT-556	550	865
1	100	Al. Ch.	AR	550	690
1	100	F.M.	H-241B	440	435
1	75	Al. Ch.	AR	2200	1765
1	75	Whse.	CS	440	1750
1	75	G.E.	KF-452	440	1200
1	75	Burke	EM-10	550	720

SLIP RING MOTORS—CONSTANT DUTY 3-PHASE, 60-CYCLE

Qu.	H.P.	M/ke	Type	Volts	RPM
2**	3000	G.E.	I.M.	2200	120
1	2000	G.E.	MT	2300	240
1	1500	Al. Ch.	ANY	2200	230
1	800	G.E.	MT-12	2200/6600	600
1**	600	G.E.	MT-412-Y	2200	719
1	500	G.E.	I.M.	2300	600
1	500	G.E.	I.M.	550	600
1	500	Whse.	C.W.	440	600
1	400	G.E.	I.M.	2300	875
1**	400	Al. Ch.	ANY	2300	514
1	400	G.E.	MT 422	2300	360
1	300	G.E.	I.M.	2200	1200
1	300	Al. Ch.	ANY	2200	505
1	275	Whse.	H.F.	440	345
1***	250	G.E.	M.T.	2300	600
1	250	Whse.	C.W.-1106	2200	600
1	200	Al. Ch.	ARY	2200	585
1	160	Whse.	C.W.	220/440	690
1	150	G.E.	I.M.	2200	1750
1	150	G.E.	I.M.	440	1180
1	125	Al. Ch.	ARY	440	900
1	75	G.E.	I.M.	220/440	695
2	50	G.E.	MT-536	2200	1150

***—3-bearing
**—MILL Type 2-pedestal bearing on cast iron

TRANSFORMERS (O. I. S. C.)

Qu.	KVA	Make	Type	Phase	Voltage
1	1000	Kuhlman	CSP	3	24000/13800/480
2	750	G-E	HTI	3	6300Y/400Y /230
4	500	G-E	H	1	13200/11880/220/440
4	500	Kuhlman	CSP	3	2400/4160Y/480
3	130	G-E	H	1	19000/9500/550/2200
3	100	Whse	SK	1	12075/11500/460/230
3	100	G-E	Auto	1	4500/2400
8	100	G-E	H	1	4160/7200Y/120/240
3	100	G-E	H	1	2400/4800/120/240/480
3	75	G-E	H	1	2400/4160Y /120/240
2	50	Wag.	HE	1	13200/11880/550/287
3	50	Al-Ch		1	22000/220
2	25	G-E	HBA	1	2400/4160Y/120/240
1	25	Whse	S	1	2200/220/110

(WE HAVE MANY SMALLER UNITS IN STOCK. SEND US YOUR SPECIFICATIONS)

MOTOR GENERATOR SETS 3-PHASE, 60-CYCLE

Qu.	KW	Make	RPM	Volts D.C.	Volts A.C.
1	1000	G.E.	514	600	4160/2300
1	750	Al. Ch.	720	250	440
1	750	G.E.	514	275/300	4160/2300
1	600	G.E.	720	300	2300/440
1	400	Whse.	720	550	2200
1	300	G.E.	720	250	2200/440
1	200	Burke	720	250	2200/440
1	100	Reliance	1200	275	440
1	100	G.E.	1200	250	2300/440
1	100	Cr. Wh.	720	250	2300/440
2	94	G.E.	1200	62.5	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	1260	120	440/220
1	50	Lo. Al.	1200	120/240	2200/440
2	35	G.E.	1800	125	440/220
1	25	Whse.	1200	120/240	440/220
6	25	Whse.	1200	120/240	440/220
1	15	Al. Ch.	1200	250	440/220
1	9	G.E.	1750	250	440/220

T. B. MAC CABE COMPANY

4312 CLARISSA ST. **PHILADELFHIA, PENNA.**

MOTORS

1—300 KW G-E Rotary Converter 3 60 440 (transformers for 2300) 250 275 v. DC, 900 RPM, w control

2—60 HP 1200 RPM *NEW WHSE* CS 3 60 440 BB Fr 505 List less 40%

6—100 HP, 1800 RPM Rebuilt G-E KTP 543, 3 60 440

3—125 HP 1200 RPM Rebuilt Elec. Machy. SYN. Type BRKT Unity P.F. 3 60 440

175—3 HP 10.3 RPM Unused G-E Elevator Gear Motors 3 60 220 440 Tot. Encl., 15 MIN., w brake, shaft 3 1/8" diam.

1—6½ HP, 415/930 RPM Whse, S, 230 v. DC.

1—10 HP, 400/1600 RPM Whse, SK93, 230 v. DC.

C & S MACHINERY COMPANY

715 Howard St., St. Louis 6, Mo.

SURPLUS ELECTRICAL EQUIPMENT

2—2100 HP, GE Synchronous motors, 514 RPM, 4000/2300 V, 3 phase, 60 cycle, 80% P.F. Complete with rheostats and belted exciters. Full details on application.

2—2000 KVA Transformers—Single phase 60 cycle 69/34.5 KV to 4800/2400 V. Westinghouse O.I.S.C.

1—3500 KVA—3 phase, 60 cycle, 33/13.8 KV Westinghouse Transformer.

1—600 A., 3 P.S.T., 34.5 KV Outdoor O.C.B. Westinghouse CO-1-A

1—3 pole, 600 A, 34.5 KV Outdoor Disconnect Switch.

Miscellaneous Distribution Transformers, Cable, Switches, Potheads and Electrical Instruments. Also Ross Carrier—hardly used. Arch measurements—91" high and 76" wide. 7 Ton capacity.

All the above are for immediate sale and are located at our Pulp Mill on Vancouver Island.

BLOEDEL, STEWART & WELCH, LTD

901 Standard Building, Vancouver, B. C.

POWER EQUIPMENT—READY TO SHIP

A.C. MOTORS—3 PH. 60 CY.

No.	H.P.	Make	Type	RPM	Volts
1 NEW	500	Elec. Mach.	Syn.	120	4000/2200 220/440
1	350	G.E.	Syn.	600	220/440
1 NEW	290	Westing.	Syn.	1200	220/440
2	300	G.E.	IE	1200	2200
2 Vert.	250	G.E.		1200	2200
1	250	G.E.	K-tefc	509	220/440/550
1	200	G.E.	I-E	800	2200
2	200	Westing.	CS	900	2300/4000
1	200	G.E.	Syn.	1800	2200/440/220
1	175	Westing.	HI-torq.	1200	220/440
1	150	Westing.	Syn	257	220/440
1	150	Westing.	Syn.	450	220/440
1	150	Westing.	CS-956A	580	4000/2300
1	150	Westing.	CS-856S	880	220/440
1	150	Westing.	MS	1200	220/440
3	150	Louis Allis splash proof	FX	180	220/440
1	125	Elec. Mach.	Syn.	164	220/440
1 NEW	125	Elec. Mach.		585	4160/2300
1	125	Westg.	CS	630	220/440
1	150	Westg.	CS	900	220/440
1	150	Westg.	CS-956A	720	2200/4000
1	125	Westing.	CS-867C	1115	220/440
1	125	G.E.	IK	900	440/220
1 TEFC	125	Westing.	CS	3600	220/440
1	112	Westg.	Syn.	1200	220/440
1	100	Reliance	IP	495	220/440
1	100	Westing.	CS	580	220/440
1	100	G.E.	IK	720	220/440
1 Vert.	100	G.E.	XPR	885	220/440
1	100	Wagner		870	220/440
1	100	Westing.	Syn.	900	220/440
1	100	Westing.		1200	220/440
2 TEFC	100	Master	PX	1750	220/440
1	100	Armour	AH	1750	220/440
1	100	Louis Allis splash proof	OGS	1750	220/440
1	100	Westg.	CS-867C Hi-Torq.	830	220/440
1	75	Stanley		600	220/440
1	75	Chandey	Syn.	600	220/440
1	75	G.E.	IK	600	220/440
1	75	G.E.	KF	900	220/440
1	75	Elec. Mach.	Syn.	900	220/440
1	75	G.E.		720	220/440
1	75	G.E.	KT	1150	220/440
1	75	Louis Allis	Hi-Torq. splash pf.	1150	220/440
1	75	Westg.	TEFC	1750	220/440
2	60	G.E.	IK	600	220/440
1	60	G.E.	KF	700	220/440
1	60	Burke	KM	900	220/440
2	60	G.E.	KT	900	220/440
2	60	Westg.	CS	900	220/440
3	60	Westg.	CS	1200	220/440
1	60	G.E.	KT	1800	220/440
2	50	G.E.	KF	860	220/440

AXIAL FLOW VENTILATING FANS

25—6000 cfm Sturtevant Bulletin 512089, 25" stat pres, 7 blade, dir. con. 5/1.5 HP., 1565/1175 rpm., 220/440 v. 3 ph. 60 cy. West. TEFC Motors.

BARGAINS FOR SALE
100 KW. Diesel Engine Generator Sets

6—100 KW., 250 275 V. D.C. Delco Generators dir. con. to 156 HP. Model GBD-8, 5½x7, 8 cyl. Superior Diesel Engines, elec. starting, power panel and accessories.

1—100 KW., same as above with 220 or 440 V.. New A.C. Generators.

2—37½ KVA. 220/440 V. 3 ph. 60 cy Buda Lanova Diesel.

SLIP RING MOTORS—3 ph. 60 cy.

No.	H.P.	Make	RPM	Volts
2	800	West. CW	507	6600
1	200	West. CW	1800	220/440
1	150	West. CW	1750	2200/220/440
1	125	West. CW	860	2200/220/440
1	100	West. CW	720	2200/220/440
1	100	Triumph C-17	580	550/440/220
1	75	G.E.I-M	720	220/440
1	75	West. CW	1800	220/440
1	60	West. CW	900	220/440
1	60	G.E.	570	220/440
1	50	Burke	1200	220/440
1	50	G.E. IM	720	220/440
1	50	West. CW	870	2200/220/440

VARIABLE SPEED MOTORS—230 V. D.C.

No.	H.P.	Make	Type	RPM
1	200	Westg.	SK-210	500/2000
2	200	Reliance	1976-T	400/1200
1	100	Westg.	SK-190	500/1000
1	100	Westg.	SK	600/1200
1	75	Westg.	SK	1100/1800
2	75	Westg.	SK	850/1700
1	75	Westg.	SK-151	250/1000
1	50	Westg.	SK-150	875/1750
1	50	Westg.	SK-151	250/1000
1	50	Westg.	SK-191	350/1050
1	50	Westg.	SK-145	850/1750
1	40	Cr. Wh.	CMC	500/1500
1	20	Westg.	SK-122	400/1600

SYNCHRONOUS MOTORS

1 New 500 HP., Elec. Machy. Co. 2200/220 or 440 v. 120 rpm.

ENGINE GENERATOR SETS

1—125 kva. 220/440 v. 3 ph. 60 cy. 257 rpm. Erie Ball STEAM.

1—125 kva. G.E. 220/440 v. 3 ph. 60 cy., dir. con. Skinner UNIFLOW Engine.

A. C. GENERATORS—3 ph. 60 cy.

No.	KVA.	Make	RPM	Volts
1 new	450	Elec. Mach	120	4000/220 220/440
1 new	250	Westg.	1200	220/440
1	100	Elec. Mach.	164	220/440
1	100	Westg.	600	220/440
1	75	Elec. Mach.	900	200/440
1	50	G.E.	1200	220/440
1 new	50	Elec. Mach.	1200	220/440
1	37½	Ft. Wayne	1200	200/440
1 new	25	G.E.	900	220/440

MOTOR GENERATOR SETS—250 V.D.C.

Motors 220/440 volt or 2200 volt 3 phase, 60 cycle

No.	KW	Make	RPM
3	250	Westinghouse	1200
1	200	Westinghouse	720
2	200	Westinghouse	1200
1	100	Westinghouse	720
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	580
1	100	Delco	1200
2	90	Westinghouse	680
1	75	Westinghouse	720
1	75	Westinghouse	1200
1	60	Westinghouse	1200
1 NEW	50	General Electric	1800
3	40	Westinghouse	900
2	30	Westinghouse	720

125 V. DC M.G. Sets

1—100 kw. G.E. 125 v. 900 rpm. 220/440 v. 3 ph. 60 cy. AC Syn.

1—75 kw. West. 125 v. 1200 rpm. 220/440 v. 3 ph. 60 cy. Syn.

BRAND NEW TURBO SET

Westinghouse Steam Turbine consisting of 200 kw., 220/440 v., 3 ph. 60 cy. 1200 rpm., 80% P.F. A.C. Generator—40 kw., 120 v. 1200 rpm., D.C. Exciter and Westinghouse Reduction Gear.—Non-condensing.

SPECIAL BARGAIN AIR COMPRESSOR

6—240 CFM Westinghouse type 3 VS-23 3 cyl. vert., 150 lbs. pres. dir. con., to 50 HP., 220 440 or 2200 v. 3 ph. 60 cy. West Slip Ring Motors, auto. control. Can furnish D.C. Motors or Oil or Gasoline Engines if desired.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

TRANSFORMERS
FOR SALE

TO—1½ KVA Wag 7200—120/240
50— 5 KVA G-E 2300—115/230
6— 5 KVA W-H 13200—120/240
3— 50 KVA W-H 4800/8320Y—120/240
3— 50 KVA Pitts 26400—2300/4000Y
3— 50 KVA G-E 33000—2400/4160Y
3— 75 KVA W-H 230/460—115/230 DRY
3—100 KVA G-E 11000—2300/4000Y
3—100 KVA G-E 33000—2300/4000Y
3—150 KVA L-M 2400/4160—120/240
3—150 KVA G-E 6600—440
3—150 KVA G-E 22000—2300/4000Y
2—200 KVA G-E 6900/11950Y—460/230/115
1—200 KVA G-E 6600/11430Y—2300
3—200 KVA Mol 7200/12470Y—240/480 25 cyc.
3—333 KVA G-E 3300—2300/4000Y
1—400 KVA G-E 13200—120/240

Many other items in stock

TRANSFORMERS
WANTED

Reliable rewind and repair service on all makes of transformers.

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

Item A: New—never erected—two 190 HP, 3-drum boilers. 160#. With underfeed stokers, soot blowers, fans, controls. Cost $25,000. Sacrifice at $17,000.

Item B: 5000 KW Condensing Turbo Generator. 175#. 550° T.T. 6600 volts. Built 1929. Rebladed and entirely overhauled 1945.

Item C: Three 333 KVA transformers. Single phase. 2400 primary. 220/440 secondary. Almost new. $3,150.

PAUL STEWART
CINCINNATI, OHIO.

MAIN 5873 UNION TRUST BUILDING MAIN 3427

SLIP RING MOTORS

3-Ph., 60 Cy.

HP	Volts	Make	Speed
450	440/220	Whse.	514
300	2200/550	G.E.	900
250	2200/440	Whse	600
200	440/220	Whse	514
200	440/220	Whse	900
200	2300/440	G.E.	1200
200	440	G.E.	450
150	440/220	Whse. (2)	1800
150	2200/440	G.E.	1200
150	440/220	G.E.	720
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900
100	2200/550	G.E.	1800
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800
75	440/220	Whse. 25 cy.	750

SYNCHRONOUS MOTORS

3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
600	2300/440	G.E.	T-S	1200
600	440/220	G.E.	ATI	900
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
280	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
240	440/220	Whse.	G	1800
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

GENERATOR SETS

1—62½ kva. 1200 rpm, 220 volt, Whse., geared to 7300 rpm, Whse., non-cond. steam turbine, 150 lbs. pr.
2—unused 25 kva, 120/208 v., 3 ph., 1200 rpm, generator dir. conn. to Waukesha 6 cyl. gas engine

AIR COMPRESSOR UNIT

1—13" and 9" by 10" Worthington FEATHER-VALVE, 285 rpm. 110 lbs. pr. motor-driven.

CIRCUIT BREAKERS

3—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse, 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
300	2200/550	Whse.	CS	1800
250	2200/440	L. Allis	OGS	1200
200	440	G.E.	IK	514
200	440/320	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	KF	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	G.E.	IK	450
100	2200/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B Brg.	1800
150 vert.	440/220	G.E.	KTF	1200
150	440/220	G. E.	IK	514
125	440/220(2)	G. E.	IK	514
125 vert.	440/220	G.E.	KTF	1200
100	550	Cr. Wh.	Q	900
100	2200/440	G.E.	K	1200
60	440/220 (new)	L. Allis	OGA	1800

A. C. GENERATORS

1—500 kva, 1200 rpm, 2300/440 v., G.E.
1—830 kva., 600 rpm., 440/220 v., G.E.
1—250 kva., 720 rpm, 2300/440v., G.E.
1—250 kva., 600 rpm., 2200/440 v., G.E.
1—225k va., 800 rpm., 220/440 v., G.E.
210 kva. 1820 rpm, 440/220 volt, Westinghouse
100 k'a. 100 rpm, 440/220 volt, Westinghouse
1—112 kva 900 rpm. 440/220 v., G.E.
2—75 kva 1800 rpm 440/220 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
350	230 (2)	G. E.	CD	1150
250	230 (2 new)	Cr. Wh.	CMC	1800
200	230	Cr. Wh.	CMC	890
150	230 (new)	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1780
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

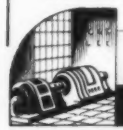
MOTOR GENERATOR SETS

1—250 kw, 1200 rpm, 250 v., 3 wire, conn. to 500 hp, 1200 rpm, 2300/440 v., G.E. syn.
1—158 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp, 1200 rpm, 440/220 v., squirrel cage
1—150 kw, 900 rpm, 240 v., Cr. Wh., conn. to 225 hp, 900 rpm, 2200/550 v., squirrel cage.
1—125 kw, 1200 rpm, 250/120 v., G.E., conn. to 175 hp, 1200 rpm, 4000/2300/440 v., synchronous
1—75 kw., 125 v., 1200 rpm., G.E. conn. to 120 hp., 2200/440 v., syn. motor.
1—50 kw., 250/1200 rpm., G.E. conn. to 75 hp., 440/220 v., 60 cy., G.E. syn. motor.

TRANSFORMERS

60 Cy.

3—500 kva, Al. Chal, 2400-480 v.
1—400 kva., G.E. 2300-230/115
3—250 kva., Whse. 2400—2400/480 volts
3—200 kva, G.E., 2400—240/480 volts
3—200 kva, Moloney, 4150/7200Y—120/240 volts
2—150 kva., G.E., 13800/6900-110/220 v.
1—150 kva., Whse. SK, 13200-125/215 v., 3 ph
3—150 kva., G. E., 2300—230/460 volts
3—100 kva, G. E., 13800—230/115 v, NEW
6—100 kva., G.E., 4400/2300-230/115, NEW.
3—100 kva., G.E., 450-115/230 v., dry, 1 ph., new
4—100 kva, G.E., 440/220—220/110 v.
2—75 kva., G.E., 2400-240/120 v.
3—75 kva., G.E., H-8-F, 2300-230/460 v



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DIESEL GENERATOR UNITS

IN STOCK—IMMEDIATE SHIPMENT

2—1250 KVA CROCKER WHEELER—NEW ALTERNATORS DIRECT CONNECTED TO FAIRBANKS MORSE MODEL 38D8—1⅛—1600 HP—720 RPM—DIESEL ENGINES.
2— 938 KVA ELECTRIC MACHINERY NEW GENERATORS, 3-60-2300 VOLT DIRECT CONNECTED TO GENERAL MOTORS MODEL 12-567-ATL DIESEL ENGINES.
2— 625 KVA WESTINGHOUSE 3-60-2300 VOLT—NEW ALTERNATORS DIRECT CONNECTED TO GENERAL MOTORS MODEL 12-567-ATL—850 HP AT 720 RPM—DIESEL ENGINES.
4— 125 KVA WESTINGHOUSE—3-60-450 VOLT—GENERATORS DIRECT CONNECTED TO GENERAL MOTORS MODEL 3-268A—150 HP—1200 RPM—DIESEL ENGINES.
2— 620 KW 240 VOLT—DC—GENERAL ELECTRIC GENERATORS DIRECT CONNECTED TO ALCO TYPE 6—12½x13-T—900 HP—700 RPM—DIESEL ENGINES.
2— 100 KW 120/240 VOLT—3 WIRE—DELCO GENERATORS DIRECT CONNECTED TO GENERAL MOTORS MODEL 3-268A—150 HP—DIESEL ENGINES.

ENGINES NEW LATE 1944—RELATIVELY FEW HOURS OPERATION

DEPT. B

WALTER H. WILMS & COMPANY

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Phone: Dunkirk 8-8147 and 8-8148

POWER PLANT EQUIPMENT

FOR SALE WITH FOLLOWING DETAILS

Steam Turbine Units

1—Allis Chalmers Alternator, 300 KW, 240 V, 900 Amps., 60 cy., 3600 RPM, d.c. exciter. Ser. No. 117765.
Kerr Turbine, S. O. 2736, A. Serial No. 2911. Type Split, Size 2007. Rated HP 437. Rated KW 300, RPM 3600. St. Pr. 150, Vac 28. Complete with condenser and all auxiliary equip. incl piping where now installed. Three section switchboard panel with oil circuit breaker, field rheostats and instruments.
1—Allis Chalmers Alternator, 300 KW, 240 volts, 900 Amps, 60 cy., 3600 RPM, with direct connected exciter, Serial No. 114611.
Kerr Turbine, S. O. 2163, Serial No. 3587. Split Type. Size C. C. Rated HP 435, KW 300, 3600 RPM. St. Pr. 140. Ex. Pr. 5, Vac. O. Super Heat O. Non-condensing.
This unit is in good operating condition, there is no condenser. Has three section switchboard panel, oil circuit breaker, field rheostat and instr. All piping & aux. devices go with it.

Ridgeway Steam Eng. Gen. Set

1—Ridgeway Eng. Gen. Set—A C Alternator, 125 KVA, No. 489, Design 42507, 80% P F 100 KW, 240 v., 3 ph., 60 cy., 225 RPM, 901 amps. Engine No. 2923, 142 HP, 225 RPM, Bore 12" Stroke 16". Steam pressure 125 lbs. Four valve. Belted Exciter, 7½ KW, 60 amps, 125 volts, 1200 RPM, No. 3863.
Three section switchboard panel with oil circuit breaker, field rheostat and instr. Gen. set comp. with all piping, valves and parts. Terrill Voltage Reg.
1—Westgh. A C Alternator, 120 KVA, 240 v, 60 cy., 3 ph., 900 RPM, New Condition. With switchbd. panel, belted exciter and oil circuit breaker.

All of this equipment must be sold immediately to make room for other operations. Can be inspected at any time. Write—

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714 Clifford Street Flint, Michigan
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GENERATOR SETS

100 KW 200 KW

General Motors Diesel engines, 8 cyl., Model 8-268A, 6½" x 7", direct conn. to: 200 KW Westinghouse Alternators, 3 60 440 V. Also 3 Cyl. General Motors Diesel sets, direct conn. to: 100 KW Century Alternators, 3 60 440 V. Inc. switchboards. Completely rebuilt, immediate shipment.

Other sizes in stock from 15 to 1000 KW AC & DC sets.

ALJOHN DIESEL CO., INC.

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Sterling 3-6515

REBUILT EQUIPMENT

12—General Electric Type FKR55-20
600 Amperes, 15000 Volts.
Oil Circuit Breakers,
3 Pole, 125 Volt DC Solenoid Operated,
150,000 KVA I. C.
Angle Iron Frame Mounted.

PRICED FOR QUICK SALE

JOSEPH SATIN CO.

1 Joralemon St. Brooklyn 2, N. Y.

1—1000 KW G.E. Type HCC, form P, 6 phase, 60 cycle, 250 volt DC, Rotary Converter with 3—4000 volt transformers and switchboards.

1—300 KW West. Synchronous M.G. Set, 250 volt, 3 wire, 1200 RPM, 3 phase, 60 cycle, 220 4000 volt AC.

3—833 KVA G.E. O.I.S.C. Transformers, 1 phase, 60 cycle, 22000 volt H.T., 4000 volt L.T.

TIPPINS MACHINERY CO.

PITTSBURGH 6, PA.

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Generator Voltage Regulators

General Electric GDA, Westinghouse Silverstat, Allis-Chalmers Rocking Contact. For AC and DC Generators All Sizes Available for Quick Delivery

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1730 Wazee St. Denver, Colorado

WORLD'S LARGEST TRANSFORMER INVENTORY

Partial Stock List as of Sept. 1, 1949
OISC-Outdoor Type 60 Cycle Single Phase

Quan.	KVA	MAKE	Prim. V.	Sec. V.
	1500	G.E.	2200	600
	1000	West.	2200	220
	750	G.E.	2200	2300
(3)	500	G.E.	11,400	2300
(3)	500	Upiegraff	12,000	2300
	500	G.E.	34,500	230/460
(3)	450	G.E.	23,000	440
(3)	333	Pitts.	13,800	230/460
	300	G.E.	6350/11,000	2300
(3)	300	G.E.	2400/4160	120/240
(3)	300	Pitts.	2300/4160	115/230
(3)	250	West.	4160/7200	120/240
(6)	250	Wagner	2400/4160	240/480
	250	Wagner	480	220/110
	250	West.	463	178
*(3)	200	West.	7200/12,470	240/480
(3)	200	Kuhlman	4150	480
	200	Wagner	4000	480/240
	200	West.	3984	115/230
*(3)	200	West.	2400/4160	240/480
	200	G.E.	495/550	120/240/440
(6)	200	G.E.	6900	2400
	180	G.E.	6400/4800/2200	1600/1200
(2)	150	G.E.	13,800	115/230
(2)	150	Wagner	2400	120/240
*(3)	150	Ntacara	2100	240/480
(2)	150	G.E.	690	120/240
(2)	125	West.	440	440
	125	AlCh	440	110/220
(3)	100	G.E.	17,200	2400/4800
(3)	100	West.	12,000	120/240/480
	100	G.E.	11,000	2300
*(3)	100	Kuhlman	7200	480
(3)	100	West.	6900	115/230/460
(6)	100	G.E.	2300	115/230
*(3)	100	Gregory	2400	240/480
(3)	100	G.E.	440	110/220
*	75	Wagner	7200	120/240
(2)	75	West.	6900	115/230
(6)	75	G.E.	6900	115/230
*(6)	75	Gregory	2400	240/480
	75	West.	2400	120/240
	75	G.E.	2200	550
	75	West.	480	120/240
	50	West.	6900	115/230
*(3)	50	Gregory	2400	240/480
(2)	50	West.	2200	220/440
	50	G.E.	460	115/230
(3)	50	Wagner	110	220
	37½	West.	7200	120/240
*(2)	37½	G.E.	4800	120/240
*(3)	37½	Gregory	2400	240/480
*	37½	West.	480	120/240
(2)	37½	G.E.	480	115/230
	37½	West.	460	115/230
	25	G.E.	24,000	2400
*	25	G.E.	4800	120/240
(6)	25	Gregory	2400	240/480
	25	Moloney	2400	120/240
(2)	25	G.E.	550	110/220
*	25	G.E.	480	120/240
	25	G.E.	230/460	115/230
	15	G.E.	550	110/220
(2)	15	G.E.	220	110
*	12½	Wagner	220	110
(2)	10	G.E.	13,800	115/230
	10	Upiegraff	5000	230
	7½	G.E.	440	110/220
	7½	G.E.	120/240	208
(2)	7½	G.E.	110	220
	5	G.E.	22,000	110/220
	5	G.E.	2400	220/440
	4	Moloney	2300	115/230
(11)	3	Wagner	2300	120/240
(35)	3	G.E.	2400	120/240
(2)	3	West.	2300	115/230
(7)	3	L.M.	2300	115/230
(4)	3	G.E.	2200	110/220

*** NEW**

Also 60 cycle and 25 cycle New and Rebuilt Air Cooled—Also New and Rebuilt Oil and Air Cooled

We also have large stocks in all ratings of AC and DC motors and generators, motor-generator sets, capacitors, AC and DC controls, oil and air circuit breakers.

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THE HOME OF VALUE AND QUALITY FOR . . .
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IN QUALITY GUARANTEED REBUILTS

CHICAGO ELECTRIC

Carries a complete stock of rebuilt equipment of the following types:

- Squirrel Cage Motors
- Synchronous Motors
- Slipring Motors
- AC and DC Generators
- DIESEL and Steam Generators
- Transformers
- Switchboards
- Controls
- Hoists and Cranes
- Compressors

REBUILDING SERVICE

Prompt guaranteed engineering work on your electrical power equipment by our staff of experienced engineers. Write today.

TRANSFORMERS

KVA	Make	Type	Pri. V.	Sec. V.
2100	G.E.	HT	13200	2300
2000	G.E.	H	25000	2300
1800	Westg.		13800	440
1667	Wagner		2300	575
1500	Gregory	BIT	4160	480
1250	Moloney	C	4160/7200Y	240/480
1200	G.E.	WCT	12000	110/87
750	Gregory	BIT	4160	480
500	Gregory	BIT	4160	480
333	G.E.	H	44000	2300/600
250	G.E.	H	13200	26400/575
200	Ferranti		2200	440
200	G.E.		7200/12575	2300/440
200	G.E.	H	2400	240/480
200	Chgo. Nero		2100	240/480
150	Moloney	HE	4600/2300	230/460
150	Chgo. Nero		13200	2300
150	G.E.	HL	2400/4160	240/480
100	Pittsburgh		66000	2300/4000Y
100	G.E.		7260/12575	2300/4000
100	Chgo. Nero		2400	120/240
50	Westg.	SK	2400/4160	240/480

MOTOR GENERATOR SETS

K.W.	Make	Volts AC	Volts DC
1500	Westg.	3/25/6600	250
1563	G.E.	3/60/2300	3/60/2300
1200	G.E.	3/60/5000	125/250
1200	Al. Ch.	3/60/4000	600
1000	Westg.	3/25/2300	250
1000	G.E.	3/60/2300	600
1000	G.E.	3/60/440	250
500	G.E.	3/25/2300	230
500	Cr. Wh.	3/60/2300	575
500	G.E.	3/60/440	250

LOW VOLTAGE M.G. SETS

K.W.	Make	Volts D.C.	Volts AC
5000	Ideal	9/18	3/60/220/440
1500	Chandy	40	3/60/220/440
1500	G.E.	60	3/60/2300/440
1000	Chandy	40	3/60/220/440
1000	G.E.	40	3/60/220/440

A.C. GENERATORS

KVA	Make	Type	Volts	Speed
1500	Westg.		2300	900
1000	Westg.		2300	900
1000	E.M.		2400/480	600
750	E.M.		2300	213
750	G.E.	TS	2300	750
560	Al. Ch.	3B	440	360
500	Westg.		440	600
500	Westg.		2300	720
500	Westg.		440	1200
500	Westg.	25 cy.	2300	750

SQUIRREL CAGE MOTORS

KVA	Make	Type	Volts	Speed
700	G.E.	K	2200	1800
500	G.E.	K	440	3600
500	G.E.	KTP	440	1800
400	Al. Ch.	Spl. pf.	2300	900
400	Westg.	C.S.	2200	1800
350	Westg.	C.S.	2200	900
300	G.E.	I.K.	440	900
250	G.E.	I.K.	2200	900
250	Westg.	C.S.	2200	1800
200	G.E.	K	2300	720
200	G.E.	K.F.	2200	705
200	Westg.	C.S.	440	720
150	G.E.	K.T.	2300	600
150	Cont.	TEFC	440	900
125	Westg.	C.S.	440	3600
125	G.E.	TEFC	440	1200
100	Al. Ch.	A.R.	440	514
100	Al. Ch.	A.R.	440	900
100	U.S.	Vert.	440	1200
100	Burke	E.M.	440	1200
75	Triumph	T.E.	2200	514
75	G.E.	F.T.	440	720
75	Westg.	Vert. K.	2200/440 / 220/440	900 / 1200
75	Al. Ch.	A.N.	440	1200
60	Al. Ch.	A.R.	440	514
60	G.E.	K.	440	1800
60	G.E.	TEFC	440	1800
50	Westg.	C.S.	440	900
50	G.E.	KT-346	440	900

SYNCHRONOUS MOTORS

1500	G.E.	ATI	4150	514
1000	Westg.		2300	900
710	G.E.	ATI	6600	720
700	G.E.	ATI	2300	720
600	G.E.	TRC	2300	450
450	E.M.		440	240
400	Westg.		2300	900
400	Westg.		2300	200
350	G.E.		2300	200
350	G.E.	TRB	2300	450
250	G.E.	ATI	440	600
250	Al. Ch.		2300/4000	720
200	Al. Ch.		2300/440	360
150	Westg.		2300	514
145	G.E.	ATI	440	900
100	G.E.	ATB	2300	900
75	G.E.	ATI	220	900
60	G.E.	TS	220	1200
15	Century		440	1200

SLIPRING MOTORS

3000	G.E.	I.M.	2200	120
1500	Westg.	H.F.	2300	233
1500	G.E.	M.T.	6600	253
1000	Al. Ch.	ANY	2300	240
800	Westg.	C.W.	6600/440	507
750	Westg.	C.W.	2300	900
750	G.E.	M.T.-16	2200	450
600	G.E.	I.M.	2300	600
600	G.E.	I.M.	440	352
500	Ideal	A.V.	2200/4000	1800
500	Al. Ch.	ANY	2300	514
400	G.M.	I.M.	2300	900
400	Al. Ch.	ANY	4000	1180
400	Al. Ch.	ANY	4000	514
350	G.E.	I.P.	2300	720
350	Westg.	C.W.	2300	450

CHICAGO Electric Co.

1320 W. CERMAK ROAD **CHICAGO 8, ILL.**
PHONE CAnal 6-2900

DIESEL GENERATOR SET!

225 HP Busch Sulzer Model DF, 3 cyl., 4 cycle, solid injection, 360 RPM. Direct connected 150 KW 3/60/2300 volt generator with direct connected exciter, air filter, muffler, etc. A modern unit in perfect condition only $4000 f.o.b. St. Louis.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. **St. Louis 1, Mo.**

Compressors — Vacuum Pumps

New and Guaranteed Rebuilts
Save 40% to 60%

SPECIALS

270 CFM 125# SULLIVAN "UNIT AIR"
610 CFM 125# INGERSOLL XCB-2
877 CFM 125# INGERSOLL XCB-2

PORTABLE COMPRESSORS

OILLESS FOR INSTRUMENT CONTROL

66 CFM—6x5 INGERSOLL ER-1
89 CFM—6x7 INGERSOLL ES-1
93 CFM—7x6 INGERSOLL ER-1
173 CFM—9x8 CHICAGO PNEU

MANY OTHER MAKES AND SIZES AVAILABLE—LIST 147

AMERICAN AIR COMPRESSOR Corp.
Dell Ave. & 47th St., North Bergen, N. J.

Most all units still on foundation. Many may be seen operating

TURBO UNITS (Cond.)

1875 KVA Al. Chal. 480 v., 400# (bleeder)
1800 KVA GE Package Type 400#
1563 KVA GE 2300 v., 225#
1250 KVA Al. Chal. 480 v., 300# (bleeder)
1250 KVA (2) Elliott 480 v., 150/200#
1250 KVA Wghse. 2300 v., 450#
1250 KVA GE 4150 v., 200#
937 KVA Al. Chal. 480 v., 150# (bleeder)
750 KVA GE 240/480 v., 150/200#

TURBO UNITS (Non-Cond.)

625 KVA GE 2300 v., 150/200#
600 KVA GE 480 v., 150/200#
250 KVA GE 600 v., 150/200#
250 KVA Wghse. 480 v., 300#
62½ KVA; 112 KVA; 125 KVA; 200 KVA and 250 KVA GE 480/220 v. units

DIESEL UNITS

500 KVA GE-Worthington; 2300 v.
282 KVA Wghse.-Winton; 240/480 v.
200 KVA FM-FM; 2400/480/240 v.
156 KVA Ideal-Buckeye 240/480 v.
109 KVA GE-Superior 240/480 v.
93 KVA GE-Superior 480/240 v.
75 KVA (2) GM 2400/480/240 v.

BOILERS

625 HP Vogt bent tube 450#
605 HP Union bent tube, 3 drum, 200#
460 HP Lasker-Adams bent tube 250#
400 HP Erie City, Heine type, 200#
250 HP Wickes bent tube, 3 drum 160#

STEAM ENGINE SETS, A.C.

900 KVA GE-Skinner Unif. ver. (new)
450 KVA GE-Ames Unif. Cond.
312 KVA GE-Chuse 4 v.
312 KVA GE-Ames Unif.
312 KVA (2) CW-Skinner Unif.
250 KVA GE-Chuse 4 v.
187 KVA GE-Chuse 4 v.
187 KVA Wghse.-Ames Unif. Ver.
62½ KVA GE-Ames Unif.

PUMPS — MOTOR DRIVEN

COMPRESSORS — MOTOR DRIVEN

TRANSFORMERS

MOTOR GENERATOR SETS

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.

COMPLETE BREWERY POWER SYSTEM CAN BE SEEN IN OPERATION

CONSISTS OF:

1 560 HP VOGT Class ML 200 Psi Boiler
1 410 HP B & W Stirling 200 Psi Boiler
1 340 HP VOGT 200 Psi Boiler
2 DEAN Bros. 250 Psi Duplex Water Pumps
1 Weinman 500 GPM Centrifugal Pump
1 Daton-Dodd 1000 GPM Centrifugal Pump
1 200 KW Skinner Steam Engine-Generator Set
1 200 KW Ames Vertical Steam Engine-Generator
1 525 CFM Ingersoll-Rand Air Compressor
1 425 CMF Ingersoll-Rand Steam Driven Compressor
1 200 Ton Vilter Ammonia Compressor
1 150 Ton H & C Ammonia Compressor W/Steam Engine
1 100 Ton H & C Ammonia Compressor W/Steam Engine
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4	60	G.E.	KT (2200 V.)	1200
1	60	Reliance	AA	900
1	100	G.E.	I-16	450
1	100	G.E.	KT (2200 V.)	900
4	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	KTP	1800
1	120	G.E.	FT	3600
2	125	Cr. Wh.	126Q	450
8	125	Al. Ch.	AR	450
2	150	Al. Ch.		1750
1	250	G.E.	I-17	900
1	250	G.E.	KP (Vert.)	3600

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3 ph.—60 cy.—220 or 440 V. (Other voltage as noted)

50	Al. Ch.		520
50	Al. Ch.		720
50	Ideal	AV	600
50	G.E.	I	700
60	Ideal	AVX	1200
75	West.	CW	400
75	G.E.	I	720
75	Fair. Morse	BV (2200 V.)	1800
100	G.E.	TRB	600
100	G.E.	I-16 (2200 V.)	450
100	West.	CW (S. P.)	1800

Qu.	HP	Make	Type	Speed
1	100	*KW* G.E.	ATB (.8 PF)	900
1	125	Fair. Morse	T (2400 V.I.O PF)	900
1	150	G.E.	TR (.8 PF)	1800
1	200	G.E.	TRC (.8 PF)	400

D.C.—230 Volt (Other voltage as noted)

1	50	West.	SK	850
1	50	G.E.	CD 1341	800/3000
3	50	Reliance	T	2700
1	50	West.	SK (115 V.)	500
1	60	West.	SK (115 V.)	800/1500
1	75	Diehl	K11	700
1	90	Cr. Wh.	CMC	225/550
1	100	West.	SK	850
1	100	Cr. Wh.	CM	600
1	130	Cr. Wh.	CMC (550 V.)	1200
1	150	West.	SK	850
1	180	Cr. Wh.	CMC	450

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3— 75 KW El. Mach. 1200 RPM	230 V DC—440 V AC	
2— 75 KW El. Prod. 1200 RPM	220 V DC—440 V AC	
1—100 KW Ridge. 1200 RPM	250/275 V DC—440 V AC	
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3—2,000 KW same as above } Also 400 & 600# Turbos
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2—1,250 KW same as above
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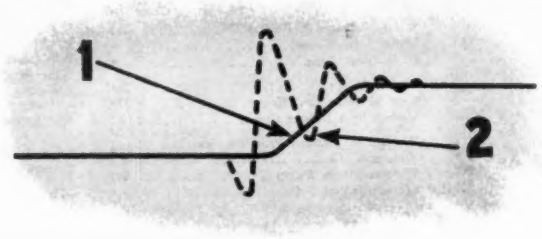

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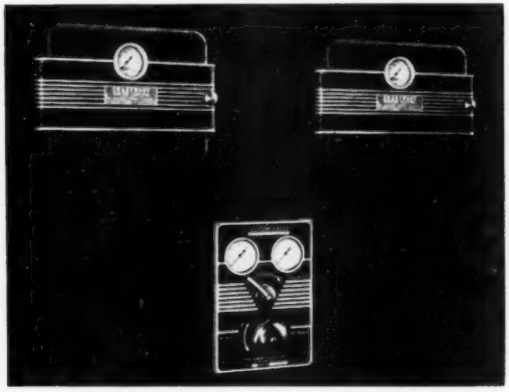

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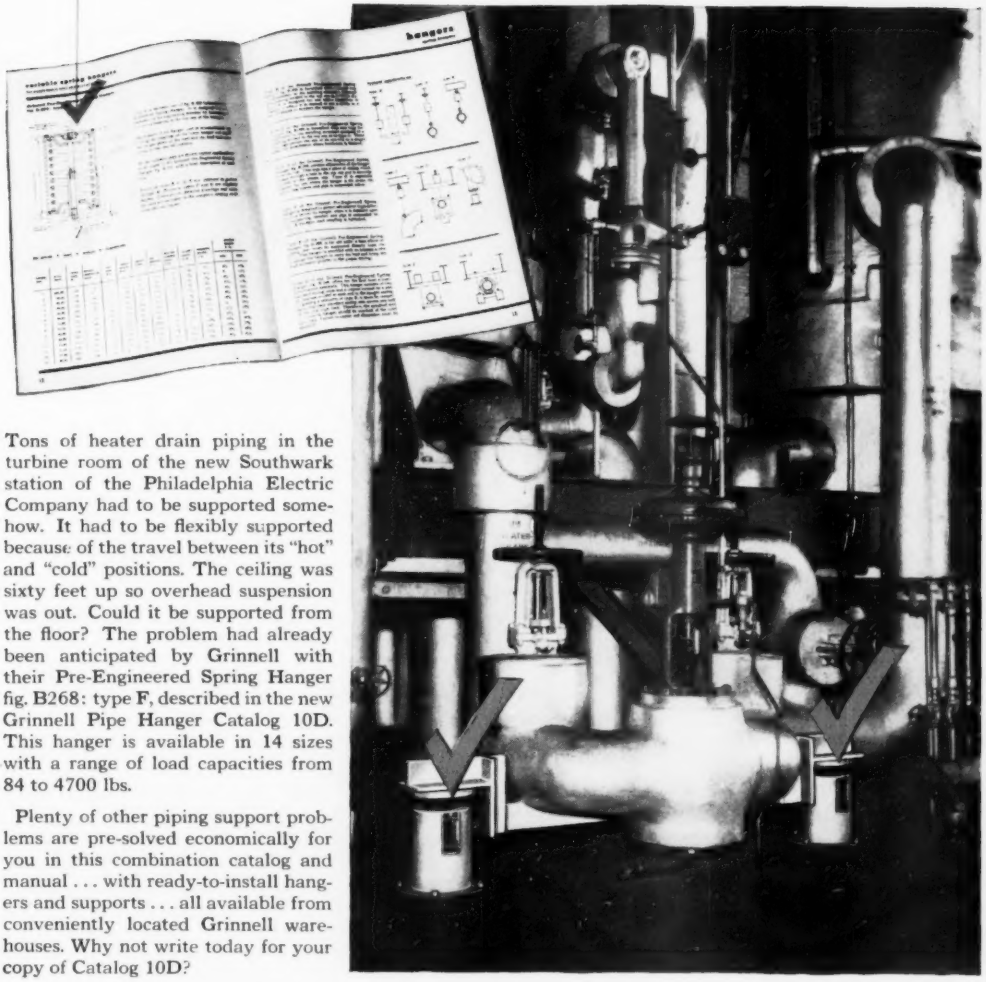

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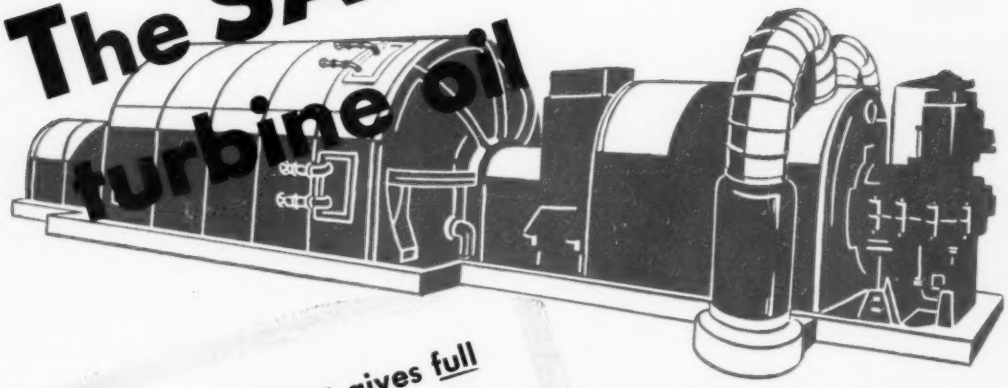

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